THE AMERICAN GAS LIGHT JOURNAL

REDWANKKENNY.N.Y.

PUBLISHING OFFICE No. 32 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME LXII.—No. 15 Whole No. 1,036. | NEW YORK, MONDAY, APRIL 15, 1895. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager.
JOS. R. THOMAS, C.E., Editor. T. J. CUNNINGHAM, Asst. Editor.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 32 Pine Street, New York.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE —
Eighteenth Annual Meeting, Western Gas Association..... 521
EDITORIALS —
Briefly Told 521
Obituary Note, Mr. Oscar Zollikoffer—Obituary Note, the Hon. Geo. M. Landers—Notes.
Proceedings of the Eleventh Annual Meeting of the Ohio Gas Light Association—Concluded from page 492... 522
Second Day, Morning Session—Discussion on Mr. Gwynn's Paper—Discussion on the Papers by Messrs. Doherty and Goodwin—Second Day, Afternoon Session—Discussion on Mr. Macfarlane's Paper—Election of Officers—Report of Committee on Place of Meeting—Report of Committee on Memorial—Report of Committee on President's Address—The Question Box—Votes of Thanks—Adjourned.
How to Prevent Electrolysis of Gas and Water Pipes, by Mr. Udo Hesse 527
Some of the Properties of Calcium Carbide by Messrs. E. P. Venable and Thos. Clarke 528
Electricity Direct from Coal, by Mr. A. H. Bucherer..... 529
*Hearne and Cisco's Machine for Tapping Mains..... 530
Discussion on the Absorption of the Illuminating Constituents of Coal Gas by Tar 531
ITEMS OF INTEREST FROM VARIOUS LOCALITIES 532
Hints from East St. Louis, Ills.—Water Gas Annex for Houston, Texas—Western Observer Has Something to Say—Changes at Rockville, Conn.—Indiana's New Inspector of Natural Gas—Senator Blodgett Wants to Know—The Athens (Ga.) Company Can Pay Its Debts—The Hartford Company's New Boiler House—Welsbach Burners at Danvers, Mass.—Cheaper Gas for Bridgeport, Conn.—The Tangle at Murphysboro, Ills.—Straightened Out—Public Lighting, Wilmington, N. C.—Annual Meeting, Montreal—A Couple of Catalogues—And other Items.
Compressed Air Motor for Street Cars..... 534
Steel Tubes by Mannesmann Process 534
The Market for Gas Securities..... 534

[OFFICIAL NOTICE.]

Eighteenth Annual Meeting, Western Gas Association.

OFFICE OF WESTERN GAS ASSOCIATION,
NEW ALBANY, IND., April 8th, 1895.

To the Members of the Western Gas Association: The 18th Annual Meeting of the Western Gas Association will be held at Pittsburgh, May 15th, 16th and 17th, 1895. The meeting will be called to order by the President, Mr. I. C. Baxter, at 10 A.M., Wednesday, May 15th.

The Monongahela House has been selected as the headquarters for the members, and the meeting of the Association will be held in a suitable room contained therein. A rate of $3 per day has been obtained for those desiring to attend the meeting.

The Central Traffic Association, Trunk Line, Boston Passenger Association and Southern Passenger Association have granted rates of 1½ fare for the round trip, conditional on 100 certificates being presented to the Secretary for indorsement.

There will be an exhibit of gas appliances, to which all manufacturers are invited to contribute. Any information as to space and place of exhibit can be obtained from Mr. F. L. Slocum, President of the Gas Engineering Company, of Pittsburgh.

This year we meet in new territory, adjacent to which are many Companies whose officials are not members of the Western Gas Association. We hope that many will embrace this opportunity to become members. The Secretary will be pleased to give those desiring to become members any information wanted, and to mail them copies of the Constitution and By-laws.

The Question Box is now ready to receive inquiries, and those obtained before the meeting will be published, so that all may come prepared to answer them. The Secretary will be pleased to have a number of questions sent him. A cordial invitation is extended to members of other Associations to attend our meeting, and it is hoped that many will avail themselves of the opportunity to be present.

JAS. W. DUNBAR, Secretary.

BRIEFLY TOLD.

OBITUARY NOTE, MR. OSCAR ZOLLIKOFFER.—A long and busy life was brought to a close in the death of Mr. Oscar Zollikoffer, whose decease occurred on Sunday, the 7th inst., at his home, 210 West 46th street, this city, after an illness of short duration. The positive cause of death was bronchitis, resulting from a severe cold. The funeral services were celebrated on last Wednesday, the Rev. Dr. G. F. Cortell, of the English Lutheran Church, officiating. In view of Mr. Zollikoffer's long and positive impress on the gas business, more especially in that it was coeval with the growth of the business in New York city, we have taken it for granted that an accurate history of his connection therewith would be appreciated by our readers; so, premising it with the remark that every fact presented is authentic, we have collated the following details.

Oscar Zollikoffer was born in St. Gall, Switzerland (the capital of a similarly named canton), from whence has been turned out many a man who subsequently made himself prominent in the place which he selected for his ultimate battle for position, on January 24th, 1810. On leaving school—his tuition was acquired in his birthplace—he took up the practical study of the manufacture of white goods and silks, for which branches of trade St. Gall has been noted for centuries, making such satisfactory progress that (1837) he was sent to America to represent here the manufacturing house with which he was connected. He arrived in New York, July 4th, 1837, and it was not long before he determined to engage in business on his own account. The first venture in this direction was under the firm name of Zollikoffer & Wetter, and later on he was a member of the concern of Zollikoffer & Blanck, both of which establishments were prominent in the dry goods importing trade of their time. In 1855 (New York then was growing with the proverbial growth of the reed), the Manhattan Gas Company had a monopoly of lighting the district adjoining the New York Gas Company's district to the north, and certain capitalists conceived the idea that there

was room for another Company. In that year the Metropolitan Gas Light Company was incorporated, and in due time the Legislature granted to its proprietors an exceedingly liberal charter. The grant occasioned much discussion, and it was openly charged that those who obtained it procured it merely for "barter and sale purposes;" but, whether so or not, the project languished for a term, until the "rights" came into the hands of men who considered them valuable enough to go on in a legitimate way. In 1859, Mr. Zollikoffer was chosen Secretary and Treasurer of the Company, and the work of constructing the plant, at the foot of West 42d street, was undertaken. The turmoil of rebellion coming, it was an extremely difficult task to enlist capital, which then was coyer than it ever was or is; but the rugged Secretary and Treasurer, with the sagacity that comes from safe commercial training, having made up his mind that, war or no war, New York was bound to grow, called upon his former commercial partners and speedily he had enlisted with him such capitalists of the early sixties as Sand, Marcuse, Ballin, Gunther, Achelis, Witthaus, Ottendorfer and others —each a financial lion of his day; and we of to-day are often minded that either they or their heirs are still potent in the marts financial. In 1863, after many a rebuff, gas was supplied from the 42d street works, and then ensued a period of a war of rates between the Metropolitan and the Manhattan Companies. Less than a year of this strife convinced both parties to the contest that there was room for each, and before '64 became '65, an agreement over a division of territory was reached, the Manhattan Company ceding to the Metropolitan the portion north of the center line of 34th street. In January, 1866, Mr. Zollikoffer was elected President of the Metropolitan Company, which position he retained until the famous merger of November, 1884, that resulted in the formation of the Consolidated Company. Mr. Zollikoffer was a consistent opponent of those in his Company who favored amalgamating their interests with the other consenting Companies; but, having been overruled by his associates, no other man in the Consolidated gave its affairs heartier or more unselfish support than he. Appreciating his worth and influence, Mr. Zollikoffer was elected a Trustee of the Consolidated Company by those who perfected its executive management, and the Trustees then named him to a Vice-Presidency of the Company and to a place on its Board of Managers. Going back to the Metropolitan Company and his connection with it, it is matter of record that the Company was, on its $2,500,000 of capital, a steady dividend payer—its annual output at the time of consolidation was 800 millions cubic feet —and, besides such returns to its shareholders, the undivided profits or accumulations were such that each shareholder received 2.6 shares of Consolidated stock for one share of Metropolitan—not too large a proportion either, according to those who knew the relative standing of all the combining Companies. Naturally, Mr. Zollikoffer was prominent in the social life of his extended circle, and in the charitable and business lines to which such social ties extend. He was one of the founders of the Germania Bank and a Trustee of the same until his death. He was also a member of and prominent in the affairs of the Chamber of Commerce, the Liederkranz, Arion and Beethoven Societies, the German Society and the German Hospital. He leaves one son—Mr. Oscar F. Zollikoffer, Secretary of the Consolidated Gas Company—and three daughters, who love to revere the memory of a father who was to his fellow men as a man should be.

Obituary Note, the Hon. George M. Landers.—We have to report the death of the Hon. George M. Landers, who passed away on the evening of March 28th, at his residence, East Main street, New Britain, Conn. While deceased was not prominent in the gas business of the country as a whole, he was nevertheless largely interested in its guarding, so far as Connecticut is concerned, for it is in no small degree that to him may be charged the present laws of Connecticut regarding the formation of new gas companies in that State. He was one of the incorporators of the New Britain Gas Light Company, and was its President (as he had been for years) at the time of his death. He was in his 86th year, and was prominent in the commercial, political and social life of New England.

Notes.—Mr. William G. Warden, one of the organizers of the United Gas Improvement Company, died at his home in Germantown, Pa., on the 9th inst. He was in his 60th year, and was one of the firm of Warden, Frew & Co., of Pittsburgh, Pa., whose properties were eventually absorbed by the Standard Oil Company.——In the reorganization of the Western Gas Company, of Milwaukee, Wis., the officers chosen were: Directors, E. McMillin, I. N. Seligman, C. B. Van Nostrand, H. B. Wilson, P. Lehman, F. Strauss and E. W. Clark, Jr.; President, E. McMillin; Vice-President, F. Strauss; Secretary and Treasurer, R. M. Murray.

[Concluded from page 492.]

PROCEEDINGS OF THE ELEVENTH ANNUAL MEETING OF THE OHIO GAS LIGHT ASSOCIATION.

Held at the Arcade Hotel, Springfield, O., March 20 and 21, 1895.

Second Day—Morning Session.

The President—We will now have a paper by Mr. E. C. Gwynn, of Springfield, on the

GROWTH OF A GAS PLANT.

We are sorry that Mr. Gwynn cannot be with us, and the Secretary will read the paper.

(For Mr. Gwynn's paper see Journal, April 1, p. 448.)

The President—We will now listen to a paper by Mr. Henry L. Doherty, of Columbus, Ohio, on

CARBIDE OF CALCIUM.

(For Mr. Doherty's paper, see Journal, March 25, p. 407.)

The President—Gentlemen, you have listened to the first paper on this subject ever read before any of the Gas Associations of the United States. As Mr. W. W. Goodwin, of Philadelphia, has also prepared a paper on the subject of

CARBIDE OF CALCIUM,

we will hear his paper read, and then both can be discussed together.

(For Mr. Goodwin's paper, see Journal, April 1, p. 449.)

Discussion.

After Mr. Goodwin finished reading his paper he exhibited samples of carbide of calcium, and made some very interesting experiments with same, including the generation and burning of the gas.

Mr. Gwynn—Mr. Doherty, do you know what the specific gravity of that gas is?

Mr. Doherty—.91; a little lighter than air.

The members engaged in an informal consideration of calcium carbide, its production, uses, etc.

Mr. Butterworth—This subject that we have before us is very interesting; but as we have many other things to attend to, I move a vote of thanks to Mr. Doherty and Mr. Goodwin for their instructive lectures.

The President—I would request a standing vote on this, and that all who favor the motion rise to their feet. (Motion carried unanimously.) I hope you will all assemble here promptly at 2 o'clock, at which time the committees will be ready to report.

And thereupon the convention recessed until 2 o'clock, P.M.

Second Day, Afternoon Session.

At 2:45 o'clock the meeting was called to order by President Cline.

The President—Mr. Macfarlane is obliged to leave on the 3 o'clock train, and if he is to read his paper it will have to be done pretty soon.

Mr. Graham Macfarlane, of Louisville, Ky., then read his paper on

CANNEL COAL AS AN ENRICHER.

(For Mr. Macfarlane's paper, see Journal, March 25, p. 411.)

Discussion.

The President—Mr. Nash, will you open up the discussion on this paper?

Mr. Nash—Mr. President, I have had some experience in enriching with cannel. I used slack bituminous coal, bringing the candle power up with cannel. Without an enricher, the coal we are using will produce about 14-candle power; but I am using a cannel, 15 per cent. of which raises the illuminating value to 17.5 candles. At the price we are getting it at we find it quite satisfactory.

The President—What cannel is it that you use?

Mr. Nash—We are using Butts'.

Mr. Holmes—I have not had any experience whatever with cannel, but we have some cannel in our neighborhood, and are about to give it a test; in the absence of that I am unable to give any special information to the audience.

Mr. Butterworth—I cannot say anything of very much value or interest. I have used both cannel and naphtha for enriching, and I could not to-day tell really which is the better and more profitable way of enriching coal gas. Each method has its advantages and disadvantages. I should think a cannel coal that would make a good coke would be a very nice thing; but, as I say, I am so uncertain as to which is the better that I think if a cannel coal man comes to me with a lower price I will buy of him, and if a naphtha man comes to me with a lower price I will buy of him. I am open to bids. Each method of enriching will

prevent the formation of naphthaline, so they are at a stand off in that respect. The coke produced by ordinary cannels is the chief objection to them.

Mr. Jenkins—I will simply say that for two years past we have been using the Pineville cannel, and it does give a remarkably fine coke. We take the coke from that cannel and use it in our furnaces; it costs us like "smoke," about $5.25 a ton.

Mr. Butterworth—You better buy calcium carbide.

Mr. Jenkins—Oil costs us nearly 5 cents a gallon.

Mr. Butterworth—With the use of naphtha there is considerable trouble in the stoppage of stand-pipes, bridge-pipes, etc., and there is a good deal of annoyance in that respect. In the cannel we do not have so much of that.

Mr. Macfarlane—We have one man in a distant city who pays $17.25 for cannel, whereas one near home won't buy it at $3. I have never been able to get any satisfactory basis of comparison myself. Different gas engineers have different ideas of what they get from naphtha.

The Secretary—What does naphtha cost the man who pays the $17.25?

Mr. Macfarlane—I do not know. He is in Utah City. I expect this costs him a good deal of money. I am under the impression that, with cannel at $5 per ton, and naphtha at 2½ cents per gallon, it is a pretty even proposition.

Mr. Wilkins—I do not know that I have any right in the discussion, but I would like to ask why there is no demand for the cannel down in the Hocking Valley region? They throw it back sometimes in the mines.

Mr. Macfarlane—I suppose it is not rich enough and not very desirable for domestic fuel. Of late years the working of the cannel coal has been mainly through domestic trade, to be burned in open fireplaces. I think there is now only one town in the United States, of over 150,000 people, that uses any quantity of it.

Mr. Wilkins—It seems to hurt it as a shipping coal.

Mr. Coombs—I would like to ask Mr. Butterworth if 18-candle gas made from cannel coal was as satisfactory as 18-candle gas made from naphtha?

Mr. Butterworth—I do not think we would notice any difference by the eye in the light. The candle power was 17 or 18. I was going to say, however, that with naphtha we could carry a candle power a little higher without smoking than we could with the cannel enriching.

The President there seems to be a dearth of remarks just at this time. Mr. Gwynn, I saw you at the door, and we would like to have you make some remarks upon this question just now.

Mr. Gwynn—I am not in it at all.

On motion of Mr. Butterworth, a vote of thanks was tendered to Mr. Macfarlane for his valuable paper.

Reports of Committees.

The President—We will now take up the reports of the Committees. First the report of the Committee on Nominations, of which, I believe, Mr. Nash is Chairman.

Mr. Nash—Mr. President, there has been a little internal trouble in the Committee. We are not all united. I will hand in the majority report. We have nominated the following: Mr. Joseph Gwynn, of Steubenville, as President; Jerome Penn, of Washington Court House, as Vice-President; and Mr. A. P. Lathrop, of Columbus, Secretary and Treasurer, to be re-elected. For members of the Executive Committee, taking the place of Messrs. McCook and McCormack: B. P. Holmes, of Youngstown, O., and G. A. Allen, of Zanesville, O. I would like to say that we understood that the retiring Vice-President, Mr. Cantine, would not accept the Presidency. Though Mr. Lathrop prefers to retire, we think the Association will insist that he had better accept the position anyway.

On motion, the report of the Committee on Nominations was unanimously adopted.

Election of Officers.

Mr. Butterworth—I move you, Mr. President, that you appoint a teller to cast the ballot of the Association for the election of officers named by the nominating committee.

The President—If there be no objections I will appoint Mr. Butterworth to act as teller, to cast the vote of the Association for these officers.

Accordingly, Mr. Butterworth cast the ballot and the officers were declared duly elected.

The President—I will appoint Mr. Penn a committe of one to introduce the President-elect.

Mr. Penn—Gentlemen, I take pleasure in introducing Mr. Gwynn, who has been chosen President for the coming year.

Mr. Gwynn—Gentlemen, while I heartily appreciate the honor you have conferred upon me by electing me President of the Association for the coming year, I think that if the Committee had paid attention to the argument I advanced they might have made a selection of one more competent to discharge the duties of the office. However, I assure you of one thing—I will do the best I can; and I think, with the assistance of the Past-Presidents and the co-operation of the members, I can manage to get through. Thanking you for the honor you have conferred upon me, I will give way to a more able speaker.

The President—I will appoint Mr. Gwynn, the newly elected President, to present the Vice-President-elect to the Association.

Mr. Penn—This looks like a set up job. I thank you, gentlemen, very much for the high honor that is offered me. I hope I may be of some assistance to our worthy President-elect, and I will certainly try to help him all I can. I feel that we ought to try every effort to make the Ohio Association more united than it has been in the past. Ohio has a reputation of furnishing great men, and also a great Association, and we don't want the Gas Light Association to fall behind.

The President—I take great pleasure in introducing to you the Secretary and Treasurer of the Association, re-elected for the coming year.

The Secretary—Gentlemen, I must say I appreciate the honor you have conferred upon me, but I honestly want to get out of the job, and I will put myself on record now that next year I would like to have you elect another Secretary.

Mr. Butterworth—I would like to say that the members would not find it so difficult to keep a good Secretary, like Mr. Lathrop, if they would be more prompt, and respond in furnishing papers at his request. This is a great trouble and difficulty. Here are 8 or 9 papers, and I think only 3 of them from Ohio men.

Report of Committee on Place of Meeting.

The President—We will now hear the report of the Committee on the Next Place of Meeting.

Mr. Welch—It has always been the policy and desire of the Association to select a place for meeting at which the Association had not previously met, but the places of this kind, for a number of years back, have been somewhat restricted. Among them might be mentioned Youngstown, Lima, Canton and others, but in the absence of definite information as to hotels and hall facilities that can be afforded there, the Committee was unable to determine. The Committee considered only Cincinnati and Dayton, and the preponderance, we find, leans toward Cincinnati. Anticipating the sense of the Association, I telegraphed General Hickenlooper this morning and have a reply. I asked him if Cincinnati was large enough to hold the Association meeting next year. He replies: "Not only is our city, but our hearts, large enough to hold you. Come to us by all means." The report of the Committee, therefore, is that Cincinnati be selected.

The President—You have heard the report of the Committee. What is your pleasure?

Mr. Butterworth—I move that the report of the Committee be adopted. (Carried.)

Report of Committee on Memorial.

The President—We will next listen to the report of the Committee appointed to draft a memorial respecting the late Mr. H. C. Felt.

Whereupon Mr. McDonald, as Chairman, presented the following:

It becomes the painful duty of your Committee to chronicle the death of one of the younger members of this Association. Mr. Henry C. Felt died on January 7th last, at St. Louis. Mr. Felt, who was in the 24th year of his age, was an agent for several years past for the American Meter Company, in Cincinnati. He was buried in St. Louis, on the 10th of January, with full Masonic honors. Your Committee recommends that proper recognition be taken of Mr. Felt's decease, by instructing the Secretary to communicate with the family of our departed associate, and express to them the regrets that are thus emphasized. We also recommend that proper record be made in the minutes of this Association of the facts herein recited. Respectfully submitted,

Donald McDonald,
Philip S. Dickey,
John D. McIlhenny,
} Committee.

On motion, the report of the Committee was adopted by the Association.

Report of Committee on President's Address.

The President—We will now hear the report of the Committee on President's Address.

Mr. Boyle—The able address of the President contains several suggestions which will furnish food for thought to the members of the As-

sociation, and if carried out will be of much benefit to our organization and business.

It is useless for your Committee to refer to the influence this address, and the warm welcome extended therein by the people of Springfield to the Association, have had upon our deliberations. We will all agree that the meeting at Springfield will go upon record as one of the most earnest, enthusiastic and beneficial we have yet had. In view of the difficulties which seem to be appearing to confront us, this interest is a good omen. We have work to do, and must be united to accomplish the best results.

Your Committee, realizing the importance of keeping up this work, even between meetings, and in preserving data and statistics which will be of benefit to us in conducting our business and in meeting the arguments of anti-monopolist legislators, make the following suggestions on the President's address:

1st. As to Welsbach lights. That each member of the Association keep a careful record of these lights put out by his company during the year, noting whether they displace gas tips, oil lamps or electric lamps, or are new business. Also a record of the renewal of mantles, and all other matters of interest to members in the use of these lamps. That each member present such tabulated statement to the Secretary by March 1, 1896.

2d. That a committee be appointed to inquire into and prepare statistics as to the cost of lighting by municipalities owning their own plants. These statistics to be presented at the next annual meeting, and to be spread upon the minutes.

Your Committee are heartily in support of the views expressed in the address as to the Federation of State Associations. Besides the many well considered points suggested in the address, we suggest that many matters arise in our business which are of purely local interest, the discussion of which would be out of place in a national convention.

W. C. Boyle,
J. Gwynn,
H. W. Douglas, } Committee.

The Secretary—Gentlemen, you have heard the report of the Committee on President's Address. What is your pleasure?

Mr. Butterworth—I move that the Secretary be instructed to prepare blanks at the expense of the Association, and mail them to the different gas companies, on which they can enter, in a uniform way, the statistics and data of their respective companies with respect to the Welsbach burner and other matters.

Mr. Boyle—There was a recommendation by the Committee that a committee be appointed, but I do not see why this would not accomplish the same results. However, there is this difficulty—the Secretary would probably only send to the members of the Association. I think the motion is a very good one, and suggests a wise plan. It would give the data in proper and uniform order.

Mr. Gwynn—I do not think it would be a good plan to appoint a committee and let it be publicly known. You will find you won't get the information you want. There are a great many who will not give a committee the information desired. It has to be gradually worked out by the individual members and furnished the Secretary. If you go into a town, find out what you can in regard to what they are doing by seeing the Corporation Clerk and looking over his records. I think a committee appointed would have an up-hill job.

Mr. Penn—I think Mr. Gwynn is right in that respect, judging from an experience of mine last season. On going to a neighboring town a year ago (I was well acquainted with the people, for I had lived there) I got data from them on personal account that I could not get publicly. I got information from one of the councilmen; but, for personal reasons, he did not want us to give it away. It is very valuable to gas men. I think I could be of some help in that manner in getting data. The partial cost of arc lights in the town alluded to was $60 each a year for 12 o'clock lighting. That estimate leaves out the taxes, insurance, depreciation and interest on bonds, and I do not know what else.

The President—It seems to me it would be proper to leave in the hands of the newly elected President the matter of the appointment of the committee or whatever arrangement the new administration may desire to make with reference to that. If it meets the approval of the Association, I will just leave it in the hands of the new President.

Mr. Nash—In that connection I would like to make a suggestion. How would it do for each member of the Association to find out all he can—each acting as a committee of one—and report to the Secretary?

Mr. Boyle—What we desire in this is information, and it does not make any difference whether it refers to electric lighting or to gas lighting. We want information in regard to municipalities owning their own plants.

Thereupon the report of the Committee on President's Address was adopted.

THE QUESTION BOX.

The President—We will now take up the Question Box. The first question is—

"What is the best way of treating iron sponge when taken from purifying boxes for revivification?"

I will call upon Mr. Hayward.

Mr. Hayward—I did not ask that question, nor the second, nor the fourth. I might be somewhat interested in answering the third. I want to preface what I have to say upon this question by saying that I compliment the Ohio Association upon the happy way they have of doing business. The revivification and the handling of iron sponge is a large subject, and a good many points could be made in regard to it. One of the difficulties I find is that local conditions govern it. There are so many things that enter into it. The first and foundation principle is, you have to keep it clean, and if your scrubbers are not efficient it will not re-oxidize. And, by the way, while it is not to my advantage to say so, when your old material is used up and you cannot revivify it, put it out of doors and leave it a year or two, letting the rains and snows percolate through it, when it will be almost as good as new. Never throw it away. In changing the boxes I have found that piling it up in a heap as high as I could get it is a good thing. It allows it to heat up. Watch it, of course, so it does not get too hot and burn. When you want to cool it off just turn it over. I would suggest, however, that it is well enough to get a little ammonia on to it from the scrubbers, but be careful not to get too much. That will help in revivification. I think I can talk on the second question: "Are street main governors a success?" If the fellow who asked that question would let me "buttonhole" him a little while I think I could convince him. We cannot get men to read circulars; we cannot get to them the knowledge that they ought to possess in regard to it. Of course, there are several kinds of governors. The old balance will do but one thing; it will maintain an even pressure and increase the volume. If it is set for 12-tenths and more gas is called for, of course the valve will open up and give more gas. The automatic governor does more than this. It changes the volume and changes the pressure at the same time, and it reduces the volume and reduces the pressure at the same time. There is the economy. Now, there is no gas man living to-day who can tell, within half an hour, just when to put his pressure on. There may be different conditions—cloudier one night than another. The weather conditions enter into it; the stores do not always light up at the same time. This is on the point of getting the best service we can. In this day of strong competition in electric lighting, etc., we are bound to look at something else besides economy. The question of making a well satisfied customer comes in. If the pressure is put on half an hour before the time it ought to be, what is the result? A man lights his gas and it "blows," and he has to turn it down until the other customers light up; then, when some of the customers have shut off, his gas begins to "blow" again. A question has come up here this morning about the matter of street governors for fuel gas. If you are to make it a success you must do it economically. If your pressure is heavy, of course they are burning more gas in the stores than they ought to; and so, in regard to the Welsbach burners, you can have too heavy pressure. On the fourth question, "What Materials can be Used for the Purification of Water Gas at the Least Cost?" That goes without saying, although there might be some question in regard to coal gas as to what is the best purifying material. If I should tell you the amount of water gas that can be purified per bushel with "iron sponge," I would not dare to have it go on record.

Mr. Penn—I would like to ask Mr. Hayward, after he has the sponge out of the boxes and piled up in a heap, how about cold weather? Is it necessary to have it in a house where it is warm?

Mr. Hayward—It will heat up right out in an open shed where it will get air.

Mr. Douglas—It wants to be put under cover, does it not?

Mr. Hayward—The temperature out doors does not enter into it at all. It heats up just as well.

Mr. Douglas—But in case you want more heat, do you use steam?

Mr. Hayward—Certainly, steam will help it. You can heat it up artificially.

Mr. Armstrong—Aside from the question of cleanness, the question of temperature enters into it very largely. I mean when the material is in the boxes. This is a point that we cannot lose sight of. If the gas goes in at a too high temperature and strikes the cold iron, it is chilled and becomes stiff, which also makes the gas and the sponge foul.

Mr. Penn—In regard to governors, you say that they are a success. You know the greatest of minds differ. Of course, I do not say they are not a success. I want to know.

Mr. Hayward—One of the greatest pleasures I have in coming to these meetings is to have a man come up to me and say, "that governor you sold me last year paid for itself in three months," and other reports like that. I will give you a fact in regard to Wheeling, W. Va. Mr. Darrah told me that one of his greatest troubles in regard to the gas works was the question of his pressure. He said it was a "Banquo's Ghost" that would never down. He never went to the theater at night but the thought was with him, "Well, I wonder if the boys turned off the pressure;" and when he was at home at night, "I wonder if the boys put on the pressure." The telephone was constantly being rung, "We have not got pressure enough. What is the matter? Give us more pressure." Now it never enters his mind. He never has answered a telephone call in regard to it. The governor gives it to them all just as they want it.

Mr. Douglas—How is the city situated; on a hill or on a level?

Mr. Hayward—The question of hill cuts no figure at all. Take the city of Fall River, Mass., which was a very hard city in which to distribute the gas successfully. They could not do it with one governor, but with four governors they have a most perfect distribution. You have to meet that question by setting district governors.

Mr. Douglas—It seems to me that the street governor depends largely upon the street main system. Our main pipe is entirely too small, and the result is that our governors are valueless. Our pressure will come on at the right time and go off at the right time, but we have a moment's fluctuation uptown.

Mr. Jenkins—I would like to ask Mr. Douglas if his governors are not serviceable for 18 hours out of the 24.

Mr. Douglas—Oh, yes.

Mr. Hayward—We understand that the district governors cannot regulate the piping system.

Mr. Nash—I would like to ask Mr. Hayward, when iron sponge becomes fouled so that it will not revivify, what he recommends as the best policy to pursue?

Mr. Hayward—You have to know how long it has been is use.

Mr. Nash—Suppose it has been used for some time and become loaded up pretty heavily with sulphur?

Mr. Hayward—A new lot, certainly. Put it outdoors and let it lie there a year or so, while the other is doing its work; it will come back in good shape.

Mr. Gwynn—I would suggest that you throw it over the river bank.

Mr. Nash—What would you do to revivify it again in a short time? Put it down to a red-hot cooking?

Mr. Hayward—Yes, of course, if you can stand it, and the town will let you do it; but it is not often you could do that without driving people out of town. You could often help the matter along by using sulphate of iron, putting it in a solution and sprinkling it well. That will help the material for some time to come.

The President—The experience we had was in burning it out in the retorts. We could keep that up for a few hours about once a month. We could not keep it up any longer than that; it would run a man out of the works, and people off the streets. It was not very successful.

Mr. Holmes—I do not know that I should say anything about governors, on account of the extreme modesty of Mr. Hayward. We secured a governor and put it in operation last fall. Our unaccounted-for gas got so very large that we tested all our meters during the summer, and were unable to account for it; but putting on the governor the 1st of December seemed to cut our unaccounted-for gas off just 50 per cent. Whether it was the governor or not I do not know. That is the result that we have had.

The President—Question No. 5 is:

"Five cubic feet of gas at 64° F. would weigh only .99 as much as 5 cubic feet at 60° F. Would it give only .99 as much light?"

Mr. Doherty—I would say that it would give only .99 as much light.

Question No. 6 is: "Which kind of pipe is best for street mains—cast or wrought iron?"

Mr. Butterworth—I presume this question is theoretical, and, leaving out of consideration the cost, the wrought iron pipes are better than the cast iron pipes; but, not leaving the cost out, the cast iron are more desirable than the wrought iron.

Mr. Nash—Would not the quality of the soil enter into and be an element of it?

Mr. Butterworth—Yes, sir.

Mr. Holmes—I feel considerably interested in this question. We have a good deal to do to-day, but the inquiry that has been made seems to leave me in doubt as to the best material. The wrought iron pipe men would claim that the life of their pipe is a good deal the longest. I know a number of instances of cities using the wrought iron—New York and other cities—and I thought it was rather a strong evidence in favor of the wrought iron pipe. I thought they would not use this if it was not for some advantage, under their pavement. I thought it was a pretty strong indorsement.

The President—Question No. 7 is:

"How low can leakage or unaccounted-for gas be kept?"

Mr. Doherty—I think that question was written on an antique chestnut desk.

Mr. Butterworth—I got reports from about 120 gas companies, and some of them reported it as low as 2 per cent.

The President—How high did they go?

Mr. Butterworth—I think Philadelphia is about 25 per cent.

The Secretary—I remember that, at the Zansville meeting, Mr. Graeff gave an account of some investigation he had made on that subject, and found some companies that did not have any leakage, but on the contrary, they sold more gas than they made.

Mr. Hayward—Some time ago I struck a town in New York where they had been running without a station meter and the pipes got to leaking. They never paid any dividends or made any money. They got into the hands of a receiver; new parties took hold of it and put it in good shape, and they found that their leakage amounted to 75 per cent. They investigated the mains the first thing, and found that the contractor had laid down a mile or two and did not do a bit of caulking, so they had been making gas and putting it into the ground all the time. The next move was to put in a governor.

Mr. Brown—In answer to Mr. Holmes, I would say that some years ago Mr. Joseph Flannery informed me that his leakage was a fraction of 1 per cent. They had wrought iron mains. I think Mr. Flannery testified to that fact before a commission or board of health.

Mr. Nash—In connection with this, especially where you hear reports of very low leakage, I think it is a good idea to ask about how much gas is sold per pound of coal carbonized. I think it takes in the question of incorrect station meter and probably imperfect mains too.

Mr. Hayward—Do you mean that it can be put in the blanks?

Mr. Nash—That tells the story; how much gas is sold to the pound of coal carbonized.

Mr. Hayward—I would suggest that there ought to be some question in regard to this fuel business. Some questions could be put into the blanks in regard to the fuel business that would be very useful.

Question No. 8 is: "Is it advisable to furnish gas by contract?"

The Secretary—I would say that, after that question had been printed, I received another question somewhat similar, from a member of the Association, who was asked to light a city clock by contract, and it can be answered in this connection. He wanted to know how he could contract for it.

Mr. Butterworth—What size burner did he want to put on it?

Mr. Prichard—I wanted to make the bid.

Mr. Penn—I had an experience of that exact kind. We have a clock on our court house that is lighted by eight burners, and the bills were up as high as $40, and as long as the commissioners did not kick I did not. After a while new commissioners came in, raised a cry and were going to kick it out entirely. I said, "I want to have a chance at this. I don't want you to do this now. I am a new man." I got to figuring, and got a Lungren lamp and put it in there. The clock worked automatically. They didn't want any more gas bills like that. I figured it out and added 50 per cent.; this amounted to $12.50 and they took it. It cost me about $8. After we got an electric light plant they put in an electric light, but it was not satisfactory, and they took it out and put in electric gas lighters.

The Secretary—Don't they have a meter in that building, Mr. Penn?

Mr. Penn—Oh, yes.

The Secretary—Why don't they run the whole thing through the meter and pay for it in that way? Isn't the building as a whole lighted, and the pipe that supplies this clock connected with the main piping of the building?

Mr. Butterworth—Why, were they not willing to pay for that light by meter?

Mr. Penn—The trouble was this: The burners, turned down in the day time, were probably burning 2 or 3 feet and may be more than that, and the bills ran up pretty high. Sometimes it got out of repair and there was too much carelessness on the part of the janitor.

Mr. Coombs—The question is: "Is it advisable to furnish gas by con-

tract?' I answer, my opinion of that matter is that we do not want to furnish gas by contract. I think it is wrong both for the consumer and the company.

Mr. Butterworth—I think probably we would all agree it is not best to furnish gas by contract; certainly if we can possibly meter it. Better make a special rate per thousand feet, and sell it by meter.

The President—I do not think it advisable to do it if it can be done in any other way; the electric light companies are trying to get out of it now. I think, though, it is a pretty big contract when they buy meters to measure their light. Question No. 9 is:

"What are the advantages of gas house coke as a domestic fuel, compared with anthracite or bituminous coal?"

Mr. Doherty—I believe that coke can be burned when the draught is insufficient to burn anthracite coal.

Mr. Butterworth—Of course, the advantages of gas coke over bituminous coal are well known. It is clean and free from soot and dirt, and bituminous coal is not.

Question No. 10 is: "What is the best method to protect pipes from frost?"

Mr. McCook—Bury them deep in the ground.

The Secretary—What do you do in case of area ways?

Mr. Butterworth—My experience is it would pay a gas company to run the service pipe in under the areas rather than to run through the areas and wrap them.

Mr. Nash—How would it do to have a box with sawdust in it?

Mr. Butterworth—That won't do. It will help it to freeze up in time, and be harder to thaw out than ever.

Question No. 11 is: "What is the best method of removing frost from service pipes?"

(No response.)

Question No. 12 is: "How can gas lighting be made more attractive?"

Mr. Butterworth—Attractive gas fixtures, Welsbach burners, and governors, clean burner tips; all of these would go a great way in making gas lighting more attractive. A good, high-candle power gas—22 or 23 candles—not higher than that.

Question No. 13 is: "Why should proportionate consumption of two meters vary when placed side by side, supplied by same service and discharging into same service?"

The Secretary—I would say I put that question in, and it is a thing that has interested me a great deal. We have at one place in Columbus a 200-light meter and a 100-light meter, side by side. They are supplied from one pipe and discharge into one pipe. One month the 200-light meter will register twice as much gas as the 100-light meter, and another month the 100-light meter will register twice as much as the 200-light meter. Another month one will not register anything. It is something I cannot account for. These meters are on the Government property and are read by an officer of the army and one of our men at the same time, and it is an actual fact that that thing works in that way. I do not see why it should.

A Member—Have you had the meters taken out and tested?

The Secretary—Yes, sir.

A Member—Both test correctly?

The Secretary—Yes, sir.

A Member—Is there more friction in one meter than there is in the other?

The Secretary—I do not know anything about that, but the conditions reverse. One month the large meter will register twice as much as the small one, and some other month the small meter will register twice as much as the large one, and another month it won't register anything. So far as I know, there is no reason why they should not each register the same amount of gas.

Mr. Hayward—The only difference being in the size of the meter?

The Secretary—That is all.

Mr. Gribbel—The difference in the age of the meters would make a difference. If one was an old meter and another a new one, you would perhaps have a greater resistance in the new meter than in the old.

Mr. Holmes—I would suggest that the temperature may change at different times, and that would have an effect on the meter. We all know that meters are greatly affected by the temperature.

Mr. Coombs—There might be one way to account for that. There might be one position in each meter where there is more friction on one point than on another, and when it is shut off the meter stands in a certain position. When started up again the meter might be on the point where the friction was greatest.

The Secretary—What starts that meter up again?

Mr. Butterworth—Increased consumption.

Mr. Coombs—The other may have gotten to the point where the friction was less each time.

A Member—Are you satisfied you are getting all the gas that goes through each month?

The Secretary—Yes, sir; we have taken the meters out several times and tested them carefully.

Mr. Gribbel—As long as it does not make any big difference in your gas bills, and you get your money, you ought to be satisfied.

The Secretary—When one meter does not register we are afraid we are not getting all our money.

Question No. 14 is: "What disposition can be made of coke breeze?"

Mr. Doherty—I asked that question merely to see to what uses it was put. It is used for several purposes. It has been used to fill ice chests, etc., and there are a number of uses it can be put to which would increase the revenue from its sale.

The President—We make steam out of it at our gas works.

Mr. Butterworth—I believe most gas companies utilize it under their boilers if necessary.

Mr. Doherty—What do you figure it is worth to you a bushel?

The President—I have not made any figures.

Mr. Butterworth—Do you use it straight, or mix it with coke?

The President—Use it straight and mix it.

Mr. Butterworth—Does it not fall through your grate bars?

The President—Yes, sir.

Mr. Gwynn—We use it with slack coal. No trouble with it then. We have got tight grates.

Mr. Penn—Do you use forced draft?

Mr. Gwynn—No, sir.

Question No. 15 is: "In what part of the street should mains be located? How deep should they be placed?"

The Secretary—I suppose that local conditions have more to do with the question than anything else. Down in Mr. Jenkins' part of the country they would not have to be very deep. In some places you could put them in the center or side of the street, according to the location of other pipes, or any other conditions that might come in.

Mr. Butterworth—In the modern paved cities I would lay a pipe line on each side of the street. We would never have to take up the pavement and would save that service work.

Mr. Hayward—I think that it is in the ordinances in some of the cities. I think it is true in Dayton. They use the asphalt pavement there.

Question No. 20 is: "Would it not further gas interests to introduce the question among the Gas Associations of the United States, regarding the advisability of raising a fund as a premium for an incandescent burner? There is now being offered in France 1,500 francs for a new incandescent burner."

Mr. Butterworth—I think there can be only one answer to that question, which, of course, is an affirmative one. That would stimulate the owners of the present incandescent burners to improve, and others to get into the field with one. It would help the gas interests.

Mr. Doherty—This question can be of value if there can be found a new burner. It might be better to create a fund to encourage the production of a new burner to help experimenters in that line. This, of course, would put a premium on production of a burner of that sort. I believe Mr. Goodwin has another surprise for us in this line if he will give it to us.

Mr. Goodwin—I was riding in a 'bus in the city of Brussels, wishing that I could find somebody who could speak my native tongue, when a gentleman spoke up and asked a question. I instantly recognized that he was an American. I said to him, "It affords me great pleasure, sir, to hear my native language once more," and we soon got into conversation. He asked, "Where are you going?" I replied, "to Paris;" and he asked, "Have you any objection to my riding with you?" I said, "No, sir, I would be glad to have you do so." Of course, in doing that we got to be pretty intimate, and I found the gentleman was from Dayton, Ohio. He soon found that I knew something about Springfield and other places, and he also found that I knew a little about gas. When we got to Paris we stopped at the same hotel, and, of course, long before that we got to be pretty good friends. We made arrangements to meet in London. He wanted some information that I could

give him, and so I made arrangements to meet him there. He, leaving a few days ahead of me, had hardly time to get to London before I received a letter asking me to shorten my visit in Paris, that he had a great surprise for me. He knew where I would be in London. I went to the office, and when I arrived there he could not wait for me to get through with my business. He wanted me to go that afternoon to look at something that was going to revolutionize the world in gas burning, and knock all other burners out. I said, "You have got a big contract on your hands." Well, the long and the short of it is, I agreed to go with him. I went there and saw another carbide of calcium. I saw another light that was quite a surprise to me. It was very much after the Welsbach. The man that had control of it was an Englishman. I proposed that he have the inventor or discoverer come from Paris to meet me on my return from Glasgow. This gentleman is a gas man. He is an American, and a red hot one. There was another gentleman who was connected with the Welsbach burner when it was first bought out, and we made arrangements to have some other investigations. In the conversation I had with the Frenchman I put this question to him: "Do you guarantee that this is not an infringement upon the Welsbach?" He said he could, and that it was entirely of a different substance from it. He gave the cost of the material used as one-fifth less. I made arrangements to get control for the United States. Without going through the history further I will say there has been a considerable correspondence since that time. I proposed to my friend to come back to this country. I have a letter in my hand, dated London, March 1st, which reads as follows: "My dear Goodwin—We now have all our plans fixed for sailing for New York," and then he goes on to say—naming the Dayton man and the other party—"We are now in Berlin, intending to act on the incandescent burner business, so that we can have it in good shape."

Mr. Butterworth—What is the date of that letter?

Mr. Goodwin—March 1st, 1895. Just as I left home I received a cablegram. It is dated London, and says, "We sail to-day." The Ohio man is with him on the steamer and will be waiting for me, when I get home, with the incandescent burner. And he proposes, of course, to give me another exhibition, and perhaps I may have another opportunity to give you another surprise.

The President—Take good care not to let him slip away from you. We have one more question:

> "What is the experience of supplying artificial gas with natural gas in case of a short supply, and is it successful?"

Mr. Butterworth—I presume this question does not mean quite that. I think it means, in case your holders get low, and works break down, and you have to fill them with gas of some kind, how would it do to turn in and use a little natural gas to keep the holders up until you could get the break repaired? Just the reverse of the other. I imagine it would be better than nothing; rather than have the holders down you would go it.

A Member—In some places don't they make a practice of putting in a certain amount, using the McKay-Critchlow process, putting in about one-third artificial gas and supplying the other two-thirds of the mixture?

Mr. Butterworth—The town of Richmond, when I was there two or three years ago, was using about one-third natural gas and two-thirds artificial gas, employing the McKay-Critchlow process. I think they bought their natural gas at 10 cents.

Votes of Thanks.

The President—Is there anything further to come before the Association?

Mr. Butterworth—If there is no other business I move that the thanks of the Association be tendered, first, to the officers of the Association at this meeting for their efficient and courteous services in our behalf; secondly, to the Springfield Gas Company for our entertainment during our stay in Springfield; and also to the press of the city.

The motion was unanimously passed.

The President—In accepting the thanks of the Association I desire to say that I am grateful to you all for your presence and help in making the meeting which is about to close a successful one. I desire to say also that we will be glad to welcome you to Springfield at any time in the future that you may desire to come. We have enjoyed your presence very much indeed.

The Secretary—I think that the thanks of the Association are really due to Mr. Goodwin, in addition to the thanks that we gave him this morning, for the exhibit he has made here. I, therefore, move that a vote of thanks be returned to Mr. Goodwin. (Carried.)

Thereupon the President declared the convention adjourned.

How to Prevent Electrolysis of Gas and Water Pipes.

By Mr. Udo Hesse, in *Paving*.

The destruction of gas, water and other metallic underground pipes by electric currents has caused considerable trouble in Saginaw, Mich., for the last few years. The presence of this destructive agent became apparent soon after the electric cars were put in operation, in the summer of 1889. The main pipes were not affected to any great extent, but the water and gas service connections suffered much, being totally destroyed in from two to four months in the vicinity of the power station of the street railway company.

Nothing, beyond a few experiments on individual pipes, was done to prevent the destruction of pipes by electricity until a few months ago. Washington avenue, the main thoroughfare from the city hall down town, traversed by a double track electric street railway, and on which the railway power station is located, was repaved for a distance of nearly one mile on a concrete foundation, necessitating systematic, prompt and effective action to prevent the continual tearing up of the concrete to repair and replace destroyed pipes. Early in the season observations were commenced to determine the extent of this electrolytic action, commonly known as electrolysis.

The voltmeter showed currents to be passing over pipes in all parts of the city on streets traversed by electric street railways; but in the examination of pipes taken from near extremities of railway lines, deterioration was detected in a very slight degree only. A "danger district" was finally decided upon, extending about half a mile either way from the power station along Washington avenue.

In our street railway system the outgoing current is conveyed by the overhead trolley wire, while the current is returned by way of the tracks and supplementary wires. Electrolysis is, in most cases, caused in the following manner: Owing to a poor track construction, consequently a high resistance return medium, electricity in large quantities escapes to the earth. The grounded portion of the current again divides a portion, the quantity depending upon the relative carrying capacity of the earth and the pipes and determined by Ohm's law, $C = \frac{E}{R}$, taking to the water and gas mains, as a means of returning to the power station. The current—sometimes increasing, sometimes decreasing, according to the nature and condition of the soil through which it passes—follows the pipes until conditions are favorable for its return to the track system, which, in our case, did not occur until the current approached the power station where the supplementary and track wires leave the earth to return to the dynamo. In leaving the pipes and returning to the earth preparatory to taking to the track and supplementary wires, to be returned to the power station, the current overcomes considerable resistance. Whenever a current of electricity passes through high resistance in the passage from one conductor to another, small particles of the first conductor are carried with the current, thus causing the chemical decomposition known as electrolysis. The rapidity with which a substance is decomposed by this action depends upon the current strength, substance acted upon and resistance overcome in the passage. The destruction of service pipes in preference to the mains, I attribute to the tendency of electricity, in the passage from one conductor to another, to leave the first conductor from a point. This tendency causes the current to flow to the smaller service connection pipes before returning to the earth and tracks, whose surfaces more nearly approach a point in form than does the flatter surface of the main.

To prevent electrolysis of pipes, the most certain way would be to insulate the current from the ground completely, but at present this method is not practically available. To reduce the current entering the earth to a minimum, and leading the grounded current back to the return conductor by means of metallic conductors, is the method generally used. By increasing the carrying capacity of the ground system to several times that of the overhead trolley wire (in Saginaw it was made about five times greater), the grounded portion of the return current can be reduced to a minimum. Now, if the current that follows along the pipes can be removed quietly by means of metallic conductors, without overcoming resistance in the passage, the cure has evidently been effected.

Two methods, varying but slightly in their details, are advanced for the removal of the current from the pipes. Both provide for the making of connections with the water and gas mains with copper wire of sufficient carrying capacity, the size of such wires depending upon the strength of current to be conveyed, and the frequency with which such connections are made. While one method provides for the connections of such wires directly with the track system, the other recommends a connection with a special overhead return feeder. The idea of the first

method is, no doubt, based on an economical accomplishment of the object without the erection of another eyesore to the public in the shape of a second overhead wire, and is objected to on the ground that should the carrying capacity of the track system be impaired by the breaking or disabling of bond wires, or otherwise, the current would be conducted directly to the pipes by metallic conductors, in which case the current would be considerably stronger than it would be under similar conditions of the track system, if the current were conducted to the pipes by means of the earth, as would be the case if the second method were used, and unless excellent facilities for the removal of the current from the pipes were afforded at the power station, the danger of electrolysis of underground pipes is apparent.

In the first method, in which equalization of flow of electricity between the tracks and pipes is the principal achievement, the entire current on the pipes is left to be removed at nearly one time at the power station, while in the second method, at certain points the pipes are relieved of a considerable proportion of the current, which is carried to an overhead return wire, equalizing the flow between pipes and return wire and removing a portion of the current without any opportunity of returning to the pipes or ground. The second system is the one adopted in Saginaw. Connections of mains with overhead return feeder were made with No. 00 copper wire at intervals of 600 feet at the power station and increasing to 1,200 feet apart.

Too great care can not be used to secure good wiring of the track system. A few broken bond wires or imperfect connections will impair the working of the system and cause electrolysis of underground pipes at such places. All connections of wires with rails, water or gas pipes, or other wires, should be made in the best possible manner and well covered with solder, to prevent the accumulation of dirt or rust directly upon the connection, thus increasing the resistance of the union. The statement that the weakest link determines the strength of a chain holds no truer than does the statement that the carrying capacity of a conductor of electricity is determined by the carrying capacity of the weakest point of the conductor.

An opening was left in the concrete over a service connection at the power station, to permit of the examination of the pipe from time to time, so as to give us an idea as to the degree of completeness with which the evil has been remedied. During the early part of October, 1894, the pipe was uncovered, after having been in the ground over three months, and slight signs of deterioration were perceptible, which we attribute to the fact that the wires from the track to the dynamo were not increased to the intended capacity. This was done immediately after this examination, and I think the next examination will result more favorably.

Some of the Properties of Calcium Carbide.

[By Messrs. F. P. Venable and Thomas Clarke, of the University of North Carolina.]

The calcium carbide used was prepared by the Willson Aluminum Company. In this preparation lime is mixed with some form of carbon, as coal tar; the mass is then heated, with stirring, until a thorough mixture is obtained. The proportions are so arranged that the mass becomes dry and hard on cooling. This mass, in lumps, is then placed in the electric furnace. In a very short time after the turning on of the current the process is complete. The molten mass can be run out of the crucible or it may be removed after cooling. On examination it is easy to see that there is more or less of carbon unchanged, or rather converted into the graphitic variety by the intense heat. Along with this are to be seen crystalline masses, lustrous and dark brownish black in color.

These are quite hard, and break with a crystalline fracture. Several efforts at effecting a separation from the graphitic carbon were unsuccessful. The luster is slowly lost on exposure to air, more rapidly if the air be filled with moisture. The whole will finally crumble down into a gray powder with particles of black graphite interspersed through it. The carbide can be kept for a year or two if placed in a tightly stoppered bottle, and is quite easily preserved if a little coal oil is placed in the vessel containing it.

By far the most interesting property of this carbide is its decomposition when brought in contact with water. The metallic carbides seem to be distinguished by the ease with which they exchange their carbon for the oxygen of water or for the radicals of various acids, the carbon combining with the hydrogen to form various hydrocarbons. Several authors have reported that the decomposition of this particular hydrocarbon caused the formation of acetylene. Experiments were carried out by us proving this fact some time before there were any publications concerning it in the chemical journals, but we were not at liberty to publish anything concerning it at that time. If the gas, as evolved, is passed through a set of absorption flasks containing ammoniacal copper solution, it will be entirely absorbed, not a bubble passing through, out of 1 or 2 liters of the gas. Thus it seems to be pure acetylene. The amount of gas yielded by any one sample will be affected to some extent by the amount of graphitic carbon present. Hence different lots will vary somewhat. The average is about 200 cc. to the gram of carbide.

If the gas be ignited as it is evolved it gives a smoky flame; if it be considerably diluted, as 1 part of gas to from 6 to 10 of air, a flame of great brilliancy and intensity is gotten. A company has been formed to introduce this as an illuminant upon the market. The cheapness of the materials used and the ease with which the gas can be formed ought to make it a valuable and useful addition to our illuminants. If too large a proportion of air be admixed a very violent explosion can be brought about by igniting it. In some cases we have noticed the flame rapidly travelling backwards along a rubber tube towards the gasometer in which the gas was stored. One explosion taught us that care was necessary in handling the mixture.

Several analyses were attempted of the carbide, but for obvious reasons failed to give very satisfactory results. In the first place there was uncombined carbon present, also a small portion of a tarry matter which could be detected by heating to high temperatures, and lastly, the specimens worked upon were several months old, and in spite of careful keeping had been slightly acted upon by the air, and so contained uncombined lime or calcium carbonate. Moissan gives C_2Ca as the formula calculated from his analyses. This would agree well with the decomposition by water: $C_2Ca + H_2O = C_2H_2 + CaO$.

Action of Hydrogen upon the Carbide.—Dry hydrogen has no action upon this carbide in the cold. Several small pieces of the carbide were placed in a piece of combustion tubing, drawn out at one end to a point suitable for testing the flame. Dry hydrogen was then passed over it, and as soon as the air was expelled the hydrogen was ignited at the jet and a lamp placed under the tube so as to heat the carbide. In a little while the colorless flame became luminous and remained so a short time. A brownish tarry matter condensed in the cooler parts of the tube. The mass of the carbide assumed a dull gray tint and a very thin white sublimate collected at a short distance from where the tube was heated. The ignition was carried on for five hours. The driving off of this tarry matter seemed to be the only action. The substance on removal from the tube was still hard. On exposure to the air, it disintegrated, and, if thrown into water, it was decomposed, showing the same behavior as the original carbide.

Action of Air and of Oxygen.—Some fresh pieces of the carbide were placed in the tube and heated while dry air was passed over them. A luminous flame was gotten as before, and the same tarry matter was driven off, and then there seemed to be no further action. Tests showed the carbide apparently unchanged at the end of prolonged heating. Oxygen was then passed over some of the carbide which was being moderately ignited. No change was observed after two hours' heating. If the temperature was very high, such as that gotten in a combustion furnace, the carbide glowed brightly, as if burning, and a nearly white powder was obtained. The combustion was imperfect, however, unless the tube was very hot and the ignition prolonged. This refers not merely to the graphitic carbon mixed with the carbide, but to the carbide itself. In several experiments the substance withdrawn from the tube, after heating some hours in oxygen, decomposed violently in water. It may be added, as was to be expected, that carbon dioxide had no appreciable action upon the carbide.

Action of Hydrochloric Acid.—Hydrochloric acid had no action upon this substance in the cold. When passed over the heated substance it caused it to swell up and assume a dirty gray appearance. A small amount of a liquid, apparently water, collected in the cooler portions of the tube, and parts of the carbide fused down in glassy globules and masses. These were soluble in water and were easily shown to be calcium chloride. White fumes were evolved, some of which settled as a white solid upon the sides of the tube.

Action of Chlorine and Bromine.—When chlorine was passed over fresh carbide in the cold no action was observed. If even a moderate heat was applied, however, the lumps of carbide glowed very brightly, swelled, and fused together. A slight yellowish white sublimate was found in the tube. The fused mass was calcium carbide.

Bromine mixed with air was then passed over the fresh carbide. In the cold no action was observed. On heating, the carbide became red and the smaller pieces glowed. The lumps fused together and bubbles were observed on the surface as if some gas was escaping from the

mass. Some condensed matter was found afterwards in the tube, and, on cooling, a peculiar odor was noticed, different from that of bromine. The fused mass dissolved readily in water and gave the tests for calcium bromide. Of course, in this and the previous experiment the black specks of graphitic carbon were found unchanged. It was easy to distinguish them from the carbide. A few pieces of the carbide were dropped into strong, freshly prepared chlorine water. There was a very violent disengagement of gas, but it was not ignited as reported by Moissan. The gas was inflammable and burnt very much like acetylene. The odor was, however, peculiar. The same experiment was tried several times with a concentrated solution of bromine in water. The action again was very violent, but there was no spontaneous ignition of the gas. Little difference could be detected between this and the action of the chlorine water.

Action of Acids.—A piece of the carbide was placed in concentrated pure sulphuric acid. A few small bubbles came off, but the action seemed slight. On heating, the action was greatly increased, and continued after the removal of the flame. A gas was given off which burned with a luminous flame.

A mixture of sulphuric acid and potassium bichromate acted most violently upon the carbide. There seemed to be a very vigorous oxidation, and several attempts at igniting the gas given off resulted in failure. There could have been very little, if any, acetylene present in it.

Strong nitric acid attacked the carbide with the formation of brown-red fumes. The gas evolved could be ignited and burned with a smoky flame.

Glacial acetic acid decomposed the carbide slowly in the cold.

It may be added that no change was observed on adding a piece of the carbide to some boiling sulphur. On allowing the mass to cool the carbide was regained in its original condition.

Action of Alkalies.—A few grams of sodium hydroxide were melted in a nickel dish and a piece of the carbide was added. There was violent action, a gas being given off which burned with a luminous flame and which was taken to be acetylene.

A small amount of sodium dioxide was also melted in a nickel dish. When the carbide was added to this it was rapidly attacked, the action being about the same as in the experiment just mentioned. An inflammable gas was evolved.

In conclusion, we would give due credit to Mr. W. R. Kenan, who carefully verified some of the experiments here recorded.

Electricity Direct from Coal.

[Read by Mr. Alfred H. Bucherer, before the Electrical Section, Franklin Institute.]

The endeavors of scientists and inventors to convert directly the potential energy of coal into electrical energy have received a fresh incentive from the interesting experiments of Dr. Borchers. So alluring are the rewards that follow the solution of this problem that men known for their conservative attitude in similar questions have hailed with extravagant delight the seeming results of the German electro-metallurgist. It is true the latter deserves high credit for testing his ingenious idea; yet, from his own account of the facts brought out in his experiments, I feel sure that as yet his endeavors have been fruitless. Such failure, it is only just to note, could not have been foreseen from the standpoint of our present knowledge of electro-chemistry. In the extensive discussion of Dr. Borchers' work, which appeared in various technical and scientific journals, one point has been altogether ignored, and this point is of such essential importance in the problem of the conversion of the potential energy of coal into electric energy that it deserves to be fully elucidated. This point is the relation of chemical to electrical energy. Dr. Borchers erroneously supposed that it would be possible to obtain an amount of electrical energy from the reaction $2CO+O_2=2CO_2$ that would be equal to the heat of formation of as much of the quantity of the reacting substances as take part in the transformation. Since v. Helmholtz has shown that such a view does conflict with facts, it is no longer legitimate to assume its correctness, still less to base upon it efficiency calculations, as was done by Dr. Borchers and Ostwald (see *Zeitschrift f. Phys. Chem.*, 1894, p. 521).

The maximum amount of work which we can derive from a chemical reaction is a definite quantity, and is independent of the kind of energy into which it is transformed. Suppose we have an unpolarizable cell and make the external resistance extremely large as compared with the internal resistance; then, if the quantity m of electricity has passed through the circuit, a proportional amount of chemical action has occurred, and the heat developed in the external circuit is equal to the electrical energy obtained. On examination we will find now that although the internal resistance was vanishingly small compared with the external resistance, yet heat has been evolved or absorbed in the interior of the cell, and it follows from the law of the conservation of energy that the heat of reaction Q is equal to the electrical energy E, minus the heat q absorbed in the cell.

$$E - q = Q$$
$$E = Q + q \qquad (1)$$

q can have a positive value or a negative value, according to whether heat was absorbed or evolved in the cell. If we consider one electro-chemical equivalent involved in the transformation and measure Q and q in electrical units, then $E = Q + q$, where E measures the E.M.F. in volts. V. Helmholtz investigated the relation which q has to E by applying the second law of thermo-dynamics. The following reasoning is similar. We know that the mechanical energy of a perfect engine working between the temperature limits $T + dT$ and T is

$$dW = q\frac{dT}{T}$$

$$q = T\frac{dW}{dT} \qquad (2)$$

Now, since the second law of thermo-dynamics holds for the transformation of heat energy into any other form of energy, it must be true for the transformations occurring in a galvanic cell. Now, as mentioned above, the E.M.F. of a cell measures the energy, if we consider the amount of transformation effected by one electro-chemical equivalent—*i. e.*, the work done by the passage of one coulomb. We can therefore substitute dE for dW, and we have by substituting dE in (2):

$$q = T\frac{dE}{dT} \qquad (3)$$

and, therefore,

$$E = Q + T\frac{dE}{dT} \qquad (4)$$

$$\frac{dE}{dT}$$

is the temperature coefficient, and it follows that if the E.M.F. of a cell increases with temperature,

$$T\frac{dE}{dT}$$

is positive, and the E.M.F. is larger than the value calculated from the heat of transformation, and heat is absorbed in the cell; whereas, if the E.M.F. decreases with temperature, the E.M.F. is smaller than the value Q expressed in electrical units. Heat is evolved in the interior of the cell. Now, in some primary cells the temperature coefficient is so small that it can be practically neglected; in others it is so great that the E.M.F. as calculated from the heat of formation will give a decidedly wrong value. With a reaction that is so different from those utilized in ordinary cells, and concerning which we know so little as the one utilized by Dr. Borchers, it is not legitimate to form any conclusions as to the E.M.F. obtainable.

The question now presents itself, what is then the maximum E.M.F. we can expect to gain from the combination of carbon monoxide with oxygen? Is there any reversible transformation, no matter into what kind of energy, about which we do know something? There *is* such an ideal process, and I will show the reasoning by which we can arrive at the desired value. The reasoning is based on the principle of the dynamical equilibrium of chemical systems, which principle is nothing else than a disguised form of the second law of thermo-dynamics. When carbon monoxide combines with oxygen, not all of it is thus oxidized, and at a definite temperature and pressure the composition of the resultant mixture of gases, consisting of CO_2, CO and O_2, is definite. Deville found experimentally that at a temperature of 3,000° Celsius 40 per cent. of the carbonic acid is dissociated at atmospheric pressure. I have calculated from this fact that at a temperature of 0° Celsius and atmospheric pressure, the fraction of dissociated CO_2 is

$$\frac{1.58}{10^{34\cdot86}}$$

If we conduct the process of combination of CO and O in such a manner that the maximum amount is being obtained, and take care that the temperature does not change, then this work depends on the initial and final condition of the gases. Now, let us suppose 2 gram molecules of carbon monoxide (*i. e.*, 56 grams at atmospheric pressure) react on 1 gram molecule (*i. e.*, 32 grams of oxygen, also at atmospheric

pressure), in a reversible manner, and that the carbonic acid formed is likewise brought to atmospheric pressure. Then evidently since, as we have seen the dissociation of the carbonic acid is extremely small, the partial pressure of the carbonic monoxide in the product of the reaction must also be very small, and the carbon monoxide, while performing work, has been brought from the atmospheric pressure to an exceedingly small pressure. Now, if the partial pressure of the CO be p_1, then the work done is

$$W = 2\,R\,T\,log.\,e\frac{1}{p_1},$$

where R is the gas constant referring to 1 gram molecule of gas, and is equal to 1.98 calories. The oxygen is similarly brought from the atmospheric pressure to a partial pressure, which is one-half of the partial pressure of the carbonic oxide; for the gases being present in the ratios in which they react on each other, two volumes of CO are present to one molecule of oxygen, and the pressure of the carbonic oxide is twice that of the oxygen. Hence the work performed by the oxygen is

$$R\,T\,log.\,e\,\frac{2}{p_1}$$

Since the carbonic acid in the reaction mixture is practically under atmospheric pressure, no work appreciably is done upon it, and the total energy obtained by the reversible combination of the two molecules of CO with 1 gram molecule of oxygen is

$$W = 2\,R\,T\,log.\,e\frac{1}{p_1} + R\,T\log.\,e\frac{2}{p_1}$$

$$W = R\,T\,log.\,e\frac{2}{p_1^3} \qquad (5)$$

Since now the fraction of the CO_2 that is dissociated at 0° Celsius is $\frac{1.58}{10^{34\cdot86}}$, it follows that the partial pressure p of the CO is $\frac{1.58}{10^{34\cdot86}}$ atmospheres. Substituting this value in equation (5) we have

$$W = RT\,log.\,e\,\frac{10^{104\cdot58}}{2}.$$

This energy refers to the chemical combination of 2 gram molecules, and is expressed in calories. To obtain the energy for the combination of one electro-chemical equivalent, expressed in electrical units, we divide by 4 × 23,039, and we have

$$E = \frac{1.98 \times 273}{4 \times 23{,}039}\,log.\,e\,\frac{10^{104\cdot58}}{2}\text{ volts.}$$

$$E = 1.41\text{ volts.}$$

This is the value for 0° Celsius. The heat of formation of carbonic acid is 68,000, and the E.M.F. calculated from this is 1.476. Therefore, by the equation of V. Helmholtz,

$$1.41 = 1.476 + 273\,\frac{d\,E}{d\,T}$$

$$\frac{d\,E}{d\,T} = -\frac{0.066}{273}$$

The E.M.F., therefore, decreases by $\frac{0.066}{273}$, volts with every increase of temperature by 1°. At the standard temperature, 18° Celsius, the E.M.F. is, therefore,

$$1.476 - 291\,\frac{0.066}{273}$$

$$1.476 - 0.07 = 1.406.$$

We thus see that the E.M.F. is somewhat smaller than assumed by Dr. Borchers. The greatest E.M.F. obtained by Dr. Borchers was 0.5 volts. The conclusion which he now draws from this result is that he has already succeeded in obtaining about 30 per cent. of the energy of the coal, whereas, the steam engine converted much less. This is another non-admissible conclusion. For, in an unpolarizable—*i. e.*, reversible cell, the maximum E.M.F. is a definite value, and if another value is experimentally observed which very appreciably differs from it, then, barring secondary actions, the reaction which is expected to furnish the electric energy does *not* occur. To say that secondary actions depress the theoretical E.M.F. is not logical in this case, for evidently, this secondary E.M.F. would have to be about twice as great as the observed E.M.F., and, therefore, could not be called secondary.

The action that took place in Dr. Borchers' apparatus is most probably one that can be found among those which were investigated and published by Mr. Mond (see London *Electrician*, January 11th, and *Digest Electrical World*. New York, February 2d.) It would lead too far to discuss in detail the work of Mond, and to single out the particular action to which the E.M.F. of the apparatus of Dr. Borchers was due.

For reasons which were well stated by the latter, it is more expedient and apparently easier to utilize the combination of carbon monoxide with oxygen for the generation of electric energy instead of that of carbon with oxygen. The work done by Dr. Borchers, though not crowned with success as yet, is nevertheless of high value on account of its instructiveness. It indicates in its general features the path that has to be followed for accomplishing a most important industrial task, the fulfilment of which we hope this century will yet witness.

Hearne and Cisco's Machine for Tapping Mains.

On February 26th U. S. Letters Patent (No. 534,881) were granted to Mr. John Hearne, of New York, and Mr. Elmer E. Cisco, of Brooklyn, N. Y., for an improved machine for tapping mains. Using the words of the specification:

Our invention relates to a gas tapping machine, and it has for its object to provide a machine adapted to be fastened upon a pipe, and so constructed that a hole may be drilled, reamed and tapped in the pipe without the escape of gas from the machine during the operation, with no loss of gas from the pipe itself, and also without danger of asphyxiation.

A further object of the invention is to provide a gas tapping machine which will comprise but few parts, and be very light and durable and capable of ready application to a pipe without the use or aid of wrenches, and by means of which drilling can be done at any angle.

The invention consists in the novel construction and combination of the several parts, as will be hereinafter fully set forth and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures and letters of reference indicate corresponding parts in all the views.

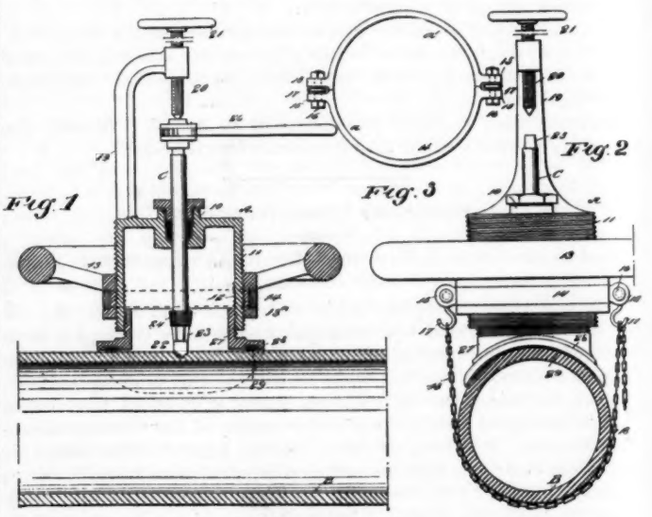


Fig. 1 Fig. 3 Fig. 2

Figure 1 is a central vertical section through the machine, and likewise a longitudinal section through a pipe to be tapped, upon which the machine is secured. Fig. 2 is a partial side elevation of the machine, the pipe being in transverse section, and Fig. 3 is a plan view of the ring carrying the attaching device.

In carrying out the invention the machine consists of a cylinder *A*, which virtually constitutes the body of the machine, the said cylinder being open at the bottom, and is provided with a stuffing box 10 at the top. The cylinder is provided further with an exterior thread 11, and with an interior thread 12 at its bottom portion. A hand wheel 13, or its equivalent, is secured upon the exterior of the cylinder, and the hub of the said wheel is provided with an exterior groove or channel 13a, in which a ring 14 is loosely fitted, whereby the ring may turn upon the wheel. This ring is shown in detail in Fig. 3, in which it will be observed it is made in two sections *a* and *a'*, each section at its ends being provided with a lug 15. Bolts 16 are passed through opposing lugs of the sections when they are in place upon the hand wheel, and a hook 17 is pendant from each of the said bolts. The said hook, however, may be substituted by an eye or an equivalent, the hooks being adapted to receive links of a chain 18, after said chain has been passed around the pipe *B* to be tapped.

A standard 19 is erected preferably upon the top portion of the cylinder, and said standard is curved at its top inwardly over the box 10, and at its upper extremity the standard is provided with a feed screw 20, turned usually by means of a hand wheel 21, or like device. A drill or combination tool *C* is passed into the cylinder and through the stuffing box 10, and the lower portion of the said tool is formed with a drill point 22, a reaming section 23 and a tapping section 24. The upper portion of the shank of the tool is squared or rendered polygonal, as shown at 25 in the drawings, to receive, for example, a ratchet wrench 26, and the feed screw is adapted to have bearing upon the upper portion of this wrench when in place, as shown in Fig. 1.

A collar 27 is provided with a flange 28, which is fitted to the outer contour of the pipe, and the said flange, or the collar proper, is provided with a suitable packing 29. The exterior of the collar flange is threaded in order that the cylinder of the machine may be screwed thereto. Thus, in operation, the collar is made to fit upon the exterior of the pipe around the surface that is to be tapped. The chain 18 is attached to one of the hooks 17, and is then passed around the pipe and secured to the other hook, and the hand wheel 13 is thereupon manipulated to tighten the chain in a manner to hold the machine firmly upon the pipe, the packing 29 in the collar 27 preventing the escape of gas from the machine. The ratchet is then manipulated together with the feed screw 20, and after the drill point has made a proper hole in the pipe the reaming section 23 will ream the said hole, while the tapping section 24 closely following will tap the hole. Meanwhile any gas that may have escaped will be contained within the chamber *A*, from which it can not escape, and consequently no odor of gas occurs where the tapping is carried on.

The machine, after the tapping is completed, may be quickly removed and a plug placed in position to close the tapped hole.

This machine is light, simple and durable, it is portable and is capable of ready application to a pipe, or disconnection therefrom.

Discussion on the Absorption of the Illuminating Constituents of Coal Gas by Tar.

At the last meeting of the Manchester District Institution of Gas Engineers, Mr. R. G. Shadbolt was down to read a paper on "Some Experiences in Gas Purification," but owing to the unfortunate illness of that gentleman the paper had not been prepared. The Chairman (Mr. Isaac Carr), who presided in the absence (also from illness) of the President (Mr. James Braddock) and the President-elect (Mr. George Smedley), thought, as a means of profitably passing the hour or so which remained of the time usually devoted to the sessions, that some of the suggestions in the inaugural address—it had been forwarded by Mr. Smedley—could be discussed. This was agreed to, with the following result:

Mr. G. E. Stevenson said it was rather an audacious thing for a member to suggest that he should start a discussion on the basis of the presidential address; but under the circumstances which the Chairman had mentioned, and with the proviso that he did not intend for a moment to discuss the address, perhaps such a suggestion might be excused, considering they had some time at their disposal. He had read through the address with great interest, and he noticed that the President said: "I shall content myself with a few notes on the method of production at the Buxton gas works, and with passing remarks, in the hope that some of our members may find a peg on which to hang a future discussion." He (Mr. Stevenson) supposed it was not at all likely that a discussion would be inaugurated at one of their meetings this year on the basis of the presidential address; and it was very good of Mr. Smedley to suggest points upon which they might enter upon discussion. Farther on in the address he did this by referring to arrangements which he had adopted at his works, but which it was not his (Mr. Stevenson's) intention to criticise. The President mentioned an arrangement he had made for introducing the gas into the condenser, and at the entrance to the condenser he had provided valves for passing the light oils which were found there either through or under the condenser. He said: "We have permanently adopted the former, as we find an increase of quite half a candle in the illuminating power by so doing." Previously he stated that he took away the tar produced in not a hydraulic main, but in a dry main, direct to the well; but he had an arrangement by which he could get the light oils into the condenser. This seemed to him (Mr. Stevenson) to start an idea for a discussion on the question of condensation and the absorption of illuminating constituents by tar and heavy oils—a subject which had often cropped up in relation to gas manufacture, and been discussed without any satisfactory solution. He did not suppose for a moment he could throw any light upon it which would lead to a satisfactory solution, but he might mention a few facts which he believed would be interesting. About two years ago one of the retort houses at the Rochdale Road (Manchester) gas works was reconstructed—that was to say, the retort bench was reconstructed—on what he believed to be modern principles; and the method adopted for taking the tar away from the hydraulic mains was a little novel. The mains were all separate from each bed of retorts, and at the back of the hydraulic mains was fixed a gas-receiving main, and below this a separate tar main. Each main had a gas outlet and a tar outlet, and the bottom of the main was made not a full ⊍ shape, but curved at the front and straight at the back. The lowest was at the bottom of the main at the back; and from that point a pipe conveyed the thick tar into a siphon, from whence it was carried into the tar main. This arrangement had worked very well. It had been found that the abstraction of the heavy tar immediately from the hydraulic main (the tar was taken off not only by the overflow, but withdrawn from the bottom of the main once a day, and the main filled up with ammoniacal liquor) had had the effect of causing the tar in bulk to contain a very small proportion of benzol and the light oils; and to that extent he believed they had proved, in the working results, that they had benefited by retaining these light oils in the gas. They had, however, had a great deal of trouble with their tar distillers in regard to this question. The principal point of the trouble had been that the heavy tar had retained a large quantity of water in connection with it. Of course, it was not desirable to sell water as tar, and there had been a good deal of agitation in Manchester gas circles in respect to this tar from the Rochdale Road works, which contained, on an average, 7 per cent. of water. The water was ammoniacal liquor held in suspension by the thick tar. He conclusively proved this, that, deducting the abnormal percentage of water from the tar, there had been nothing lost—that was to say, the ordinary production of tar had been more or less the same, on taking the water from it and adding it to the ammoniacal liquor instead; and the results had been extremely good. The question had been simply one of the quality of the tar. As it happened, during the past year pitch had been the most valuable constituent in the tar. There had been a time when the benzol and the lighter oils had been much more valuable, but they had lately been at a low price. The tar distillers informed him not long ago that they only obtained 1 gallon of benzol from their tar, whereas they usually got 3 gallons. As a set-off, however, they had had 65 per cent. of pitch, which he (Mr. Stevenson) had told them they ought to be contented with. It seemed to him that it was quite possible to make such arrangements in taking off the gas from the retorts that they would not require to afterwards recover the light oils, or to introduce them again into contact with the gas—that was, they should be able to retain them in the gas, and not abstract them at all. He had had a long discussion with Mr. Meunier, of Stockport, who had thought of experimenting with regard to maintaining the temperature of the gas and the tar until the heavy tars should have been abstracted from the gas; and his idea was that, the tar and the gas having a temperature of about 400° as they entered the hydraulic main, if the tar could then be abstracted, the light oils would not be absorbed, but would remain in the gas. He (Mr. Stevenson) thought that the idea was really a good one; but how to do it was a most difficult question. The tar would not all deposit at a high temperature, and would not deposit quickly enough to get it away before the gas fell in temperature; and for that reason, as they all knew, many attempts had been made to artificially maintain the temperature of the gas and the tar until the latter should have been abstracted. There was the Aitken process, in which it was proposed to maintain the heat by steam. Then there was the St. John process, which was experimentally used at Rochdale. That was a process which aimed at doing too much; and it tried to recarburet the gas with the tar. The great difficulty was this—that they could not accomplish what was required by steam heat, because it was not sufficient. The temperature needed was between 300° and 400°, and this they could not get with steam. To his mind, the best thing to do was to devise means by which the tar would be mechanically abstracted from the gas at that temperature—that was, before it fell below 300°. If this were done, they would have the light oils and benzol vapors left. This was what he had been endeavoring to do, and he believed he had been successful. In his opinion the gas consumers were the people to be considered, and not the tar distillers.

Mr. Shires said he should like to know where Mr. Stevenson got his 300° or 400° when he passed the vapors. One of the things he was very anxious about was this matter of benzol; and he had been going into it, as his production reached the full capacity of the works. But he found, in his case, that the temperature at the inlet of the condenser

was about 140°, and at the outlet 47° to 50°. After passing the gas through one of Walker's tar extractors, and then through a Kirkham, Hulett & Chandler washer, he had a temperature of about 20° to 24° or more in his first purifier.

Mr. Stevenson said that, of course, the abstraction of the heavier portion of the tar could not be done by cooling. The temperature of the hydraulic main would be 300° or nearly 400°; and at the inlet of the condenser they would have 150° or less. Unless the heavier portion of the tar was taken out before this, they would have passed the period in which they could do it at such a temperature as to prohibit the tar absorbing the light vapors.

Mr. T. Duxbury (Darwen) remarked that it had been very interesting to hear Mr. Stevenson relate his experience. Some of them had endeavored to take a portion of the gas out of the tar; and some had succeeded better than others. He thought there could be no question that, as gas managers, producing a bye-product like tar or anything of that nature which could be turned into illuminating matter, if it could be done, they ought to do it—it was their duty towards their employers. But they could not have the halfpenny and the cake as well; and if, in getting an increased quality or quantity of gas per ton of coal, they robbed the tar of that which somewhat reduced its richness or quantity, if it paid to do it, it was the best process to adopt. In any case, so far as the selling of the tar was concerned, the tar distillers usually looked after themselves—at all events he had found it to be so. On the other hand, he did not think there were many owners of gas works who would have much to say in either making a concession or taking a less price per ton of tar, providing a certain amount of its valuable constituents were abstracted, and sent to the consumers in the shape of luminosity. He was pleased to hear Mr. Stevenson's explanation as to how he accounted for this. Mr. Stevenson took the thick tar from the bottom of the hydraulic main; and he should like to know whether he did it more than once a day. [Mr. Stevenson—Once a day.] He (Mr. Duxbury) had not the arrangement in his own works; but if it could be provided without much cost, it would be an advantage. With reference to Mr. Shires' question, there was no doubt that the gas, in passing through the purifiers, would increase in temperature. Everyone would find that was so as a rule. The very action that took place inside the purifiers was a thermal one, so to speak; and the temperature of the gas was consequently increased by passing through them.

Mr. Stevenson concluded the discussion by saying that, as corroborating what he had said with respect to retaining the hydrocarbons in the gas, last year the Manchester Corporation Gas Committee contracted for a certain proportion of cannel and a certain proportion of coal; but during the year they had been able to keep up the illuminating power of the gas with so much less cannel that they did not know what to do with it, while they had not enough coal to finish the year with, although what he had described had only been carried out on comparatively a small portion of their plant. They had been able to make 20-candle gas with 40 per cent. of cannel, whereas they formerly used 60 per cent.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. H. Maguire, Superintendent of the East St. Louis (Ills.) gas works, writing under date of the 6th inst., says: "The gas business is good in our city. Our gas stove trade opened up two months earlier than last year. We have 1,600 Welsbach lamps in full operation and giving the best of satisfaction. They are replacing electric lights every day, much to the discomfort of the electric light men. We will lay 4 miles of 6-inch and 4-inch cast iron main pipe, between now and the last of May."

Manager McKeever, of the Houston (Tex.) Gas Light Company, having looked the field over calmly, has reached the conclusion that a water gas annex would be a "good thing to have in the house," for he has placed an order with the United Gas Improvement Company for a set of its improved standard Lowe water gas apparatus, the same to be up to an output of 250,000 cubic feet per day. The constructing Company is to furnish all the apparatus necessary to make the outfit complete. Manager McKeever will thus be enabled to use up the surplus coke from his coal benches; and is confident that he will thus meet the demand for a higher candle power gas on an economical basis. The construction work on this order is underway.

"Western Observer," writing from Chicago under date of the 5th inst., says: "I had occasion to call at a certain gas office in the West not long ago, only to find it closed. Inquiry at a nearby grocer's shop brought out this information: 'The gas office is only open on Sundays and legal holidays!' The gas man in this same town complains of poor business. It is not only fair but safe to say that many of the gas men who complain of poor business can ascribe the poor business conditions to laxity on their own part—they are not open for business. The backers of the Ogden gas scheme for Chicago—who are the proprietors of the latest gas ordinance for this city—claim to have secured a tract of land on the north side, and will soon begin to build the plant and bury the mains. The permit to open streets was issued late in the afternoon of the 1st inst., and a deposit of $20,000 was made to secure the city against loss resulting from the imperfect restoration of pavements, etc. I understand that Mr. Reichelderfer, Superintendent of the Lima (O.) works, has resigned, and that Mr. J. D. Neely, formerly of Logansport, Ind., has been appointed to succeed him."

Mr. John D. McLeod, Manager of the Rockville (Conn.) Gas and Electric Light Company, has been superseded by Mr. D. H. Burritt, of New Britain, Conn.

Prof. J. C. Leach, of Kokomo, Ind., has been appointed Inspector of Natural Gas for the State of Indiana, vice Mr. Jordan, legislated out of office for political reasons solely. We have no reason to doubt that Prof. Leach will prove a thoroughly competent inspector; but it is undeniable that Mr. Jordan's incumbency of the office has been marked by zeal, candor and proficiency.

Some weeks ago the Exchequer Court, Ottawa, delivered judgment in the suit of the Queen vs. the St. John (N. B.) Gas Company, brought by the Dominion Government to restrain the Company from depositing refuse in the harbor. The Court decided that, generally speaking, the refuse did not affect fish life in the harbor; but an injunction was granted in so far as the refuse was composed of anything like a tarry nature.

Senator Blodgett has introduced the following order in the Massachusetts Legislature: "That the Board of Gas and Electric Light Commissioners be requested to furnish to the Senate, on or before the 15th day of April current, a statement showing what amounts have been expended by the Brookline Gas Company, appearing in the account known as 'Boston contract,' or in other construction accounts which are not represented by property in the possession of the Company, and also to report what amounts have been charged to said account for legal expenditures, the purchase of gas stoves and fixtures, allowances made on gas bills, and extra repairs on streets, and any and all amounts which are not properly a part of the legitimate expense of constructing the works of the said Brookline Company. And said Board of Gas and Electric Light Commissioners is also requested to report by what amount the value of the plant of said Brookline Gas Light Company has been reduced through the abandonment and dismantling of a portion of its plant, and also whether the books of the Company are kept in the manner prescribed by law; and also whether in any manner not specified above the said Company is improperly charging items of expense to capital accounts."

Receiver Mallory, of the Athens (Ga.) Gas Light Company, having looked the situation over, gives it as his opinion that, with judicious management, the Company's assets are ample enough to liquidate all its liabibities.

The new boiler house for the Hartford City (Conn.) Gas Light Company has been completed by the Berlin Iron Bridge Company, of East Berlin, Conn. The roof is of the Berlin Company's anti-condensation material.

Supt. D. J. O'Neil, of the Danvers (Mass.) Gas Company reports the placing of 680 Welsbach incandescent gas burners. The Company will make notable extensions to its main system this season.

The special committee of the Board of Directors of the Bridgeport (Conn.) Gas Light Company, to whom was referred the matter of determining whether a concession in the selling price of gas could be made, has reported the following new schedule, and the same has been adopted by the Company—the old rate was $1.90 per 1,000 cubic feet: Ordinary consumers, $1.50 per 1,000; where the quarterly consumption amounts in value to $100, $1.45; to $200 per quarter, $1.40; $400 and over per quarter, $1.35; to the city, $1.30.

The tangle at Murphysboro, Ills., under which it looked as if that small but bustling center might have two gas plants, has been unraveled, mainly through the efforts of Mr. O. N. Guldlin, of the Western Gas Construction Company. Under the agreement the proprietors

of the Murphysboro Water Works Gas and Electric Light Company have taken over the contracts, real estate, etc., of the Murphysboro Gas Light Company, at a price that was fair to both interests; and the former will go on with the work of construction. The Western Gas Construction Company will build the plant, which it is proposed to have completed by July 1st.

THE Wilmington (N. C.) Gas Light Company's proposition to furnish gas lights on public account, at $2 per month for street locations and $2.50 per month in alley locations, a partial moontable to be followed, has been accepted by the Aldermen. The Company is also under contract to maintain public arcs (73 in number), at the rate of $9 each per month.

THE following is from the 48th annual report of the Board of Directors of the Montreal Gas Company: "Your Directors beg to submit the statement for the past year's business, showing a net profit of $300,552.13, as against $284,472.60 for the previous year, which your Directors hope will be found satisfactory when you take into consideration the depression in business during the past year, which has necessitated economy in the use of gas. There was a decrease in the revenue from the sale of gas of $35,672.30, caused by our having to reduce the price from $1.30 to 95 cents for part of the year, to meet the ruinous rates quoted by the late Consumers Company; but it is gratifying to report there was also a decrease of $40,786.44 in the operating expenses of the Company, secured by the closing down of the Ottawa street works and other reforms. Two semi-annual dividends of 5 per cent. each, amounting to $274,870.40, have been declared. In accordance with the resolution of the share holders, passed at the meeting held on October 10th, there has been issued $500,000 of new stock, of which there was paid (in stock) for the plant, mains, franchises, etc., in St. Cunegonde and St. Henri, of the Consumers Gas Company, the sum of $389,480, which your Directors decided to purchase from the Consumers Gas Company in self-defence, as that Company secured the right to supply gas in the city of Montreal and the municipalities of Cote St. Antoine, St. Cunegonde and St. Henri, and undertook to sell gas at 95 cents, which they soon found was under cost price. The balance of $110,520 of the stock was sold on the market and netted the Company $92,715.60 over par price, which amount has been placed to the credit of profit and loss account, which account would have amounted to $326,618, only that there has been $32,930 written off for bad debts, depreciation in plant, and shortage in supplies incurred during former years. There has been an increase of 4,000,000 cubic feet in gas sold, and a decrease of 20,000,000 cubic feet in gas made, showing a decrease in leakage of 24,000,000 cubic feet for the year, which is very satisfactory, considering that there has been an increase of 19 per cent. in the mileage of the street mains during the year. The illuminating power of the gas supplied for the year has ranged from 22 to 23 candles, which is several candles higher than the government standard. The contract with the city expires this year, but we expect to enter into another for a term of years, which we hope will be mutually satisfactory to the city, the shareholders and the consumers. There have been 10.25 miles of mains and services laid, in addition to 22 miles of mains and services purchased from the Consumers Gas Company. The works and plant of the Company have been maintained in a high state of efficiency, and a number of changes and additions made, which were found necessary for the economical working of the plant. There have been 793 gas stoves installed during the year, and the use of gas for cooking and heating continues to increase very satisfactorily. Your Directors have pleasure in testifying to the value of the services of Mr. Moore, the Secretary, and the continued efficiency of the officers and clerks who have discharged their several duties to the satisfaction of the Board. The following Directors retire by rotation: Messrs. J. P. Dawes, Robert Benny, Henry Joseph and Jesse Joseph, who, with the exception of Mr. Jesse Joseph, offer themselves for re-election."

THE report was taken as read, and the election for four Directors resulted in the selection of Messrs. J. P. Dawes, Robert Benny, Henry Joseph and John Crawford. The annual remuneration of President Holt was put at $10,000. and his administration of the Company's affairs was highly commended.

MR. MARCUS A. THOMPSON has filed in the Superior Court, of Chicago, a petition for a receiver for the Chicago Gas Stove Company.

THE Baltimore (Md.) *American* says that the White & Middleton Gas Engine Company, which has a factory at the southeast corner of East Falls avenue and Pratt street, is soon to erect a large, new factory at the corner of Charles and Winder streets, in South Baltimore. The present location does not afford enough room for the Company's business, and it has, therefore, been decided to erect a factory designed especially for the Company's needs. The new structure will be 80 feet by 210 feet, and two stories high. On the second floor will be the offices of the Company, with spacious rooms for draughtsmen and all clerical work connected with the business. The building will be constructed of brick and steel, with a floor of concrete. A large traveling crane will be provided for the handling of heavy work, and the machinery will be run by a large gas engine of the White & Middleton type. New machinery will be put in especially suited to the work of the Company, and the factory will have every new and labor-saving appliance. The site selected, which will be purchased as soon as the title is passed, is next door to a foundry, which will furnish the castings for the Company. The site is close to the Baltimore and Ohio Railroad, and also close to the water front. The White & Middleton Gas Engine Company was organized in this city five years ago, and since that time has occupied the present site, which it has now outgrown.

THE following propositions were submitted, on the 4th inst., by the Montreal Gas Company, to the Light Committee of the Board of Aldermen for the supply of gas to the city and the citizens—the propositions bear the signature of Mr. H. S. Holt, President of the Company:

"As requested by your Committee, I submit the three following offers for the supply of gas to the city and consumers of Montreal:

"(1) For a 10-year contract at 10 cents less per 1,000 cubic feet for lighting than the present contract, making the price $1.30 net per 1,000 cubic feet for lighting, and $1 net per 1,000 cubic feet for cooking and heating gas. And the Company will supply all gas lamps required by the city at the present rate, $17 per lamp, which is $3 less than the contract entered into before.

"(2) For a 30-year contract the Company will agree to pay the city 3 per cent. of its gross earnings from the sale of gas in the city. This is the amount paid by the Providence Gas Company, in the State of Rhode Island, they having an exclusive franchise from the city for 25 years.

"(3) For a 30 year contract the Company will agree to limit its dividends to a maximum of 12 per cent. per annum, and that all surplus earnings over and above the amount required will be applied to the reduction in price of gas to the consumers from time to time."

THE communication was referred to sub-committee of the Light Committee of the Board, comprising Aldermen Marsolais, Prefontaine and Nolan.

WE are in receipt of the handsome, new catalogue issued by the P. H. & F. M. Roots Company, of Connersville, Ind., which illustrates and describes the latest improvements in the Roots' blower specialties. It goes without saying that the improvements have also been applied to the Company's gas exhausters and rotary force pumps.

ANOTHER handsome and handy catalogue, that will be welcomed to the desk of every gas man, is the one published this month by the Ludlow Valve Manufacturing Company, of Troy, N. Y. The make up of the catalogue is of the best order, and its compiler is to be congratulated on his nice sense of arrangement.

THE Delaware County Gas Company, of Chester, Pa., on the 5th inst., sued out a writ of injunction against the City of Chester, restraining it from blasting in the streets, for the purpose of constructing a sewer, in such manner as to damage the street mains of the complainant.

THE proprietors of the Malden and Melrose (Mass.) Gas Company were astonished some days ago on receiving a bill from the city for $3,800, which sum it is claimed represents the amount of damage done to the sewer pipes of the city through an explosion of gas in the same last February. The city asserts that the explosion was the result of the Company's negligence in failing to keep its main pipes in repair. The Company refuses to pay the bill, alleging that the leaks in its mains were directly attributable to the careless manner in which the sewers were constructed. The courts will be called upon to settle the matter.

THE proprietors of the Coldwater (Mich.) Gas Light Company have made a notable reduction in gas rates. Under the new schedule gas for illumination is to be billed at $1.75 per 1,000 cubic feet, and prompt payment entitles the user to a reduction of 25 cents per 1,000. For cooking, heating and power purposes the user is to be billed at $1.50 per 1,000, and a like rebate as for an illuminating use applies in case of prompt payment. The old rates were $2 and $1.80 per 1,000, respectively.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

EDITOR - Jos. R. Thomas, C.E.
ASST. EDITOR - T. J. Cunningham.
MANAGER - C. E. Sanderson.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 32 Pine Street, New York.

TERMS:
SUBSCRIPTION—Three Dollars per annum, in advance.
Single copies, 10 Cents.

MONDAY, APRIL 15, 1895.

Compressed Air Motor for Street Cars.

The Rome (N. Y.) *Sentinel* says that in a recent trial in that city of the Hardie air motor, Mr. Robert Hardie, inventor of the motor, directed its operation. Mr. Stebbins, of the draughting department of the works, assisted in giving the visitors information. The trial was made on the 800 feet of rough track in the yard of the works, with Engineer Williams at the lever. The car started out with 1,800 pounds of air pressure to the square inch and a temperature of 310° on its hot water tank, which is used to great advantage in heating the air before it passes at reduced pressure to the engine cylinders. A valve constructed for the purpose reduces the pressure of the stored air to 140 or 150 pounds, and this is the working pressure, or the pressure at which the air enters the engine cylinders. The motor starts gently, runs smoothly at a rapid rate, and stops by air brake without jerk or jar. It was run back and forth repeatedly for upward of 40 trips, and the test showed that under the conditions applied the motor would run 12 miles from one charging of compressed air, and make 70 stops.

The method of recharging the storage cylinders with compressed air was shown. It is a very simple operation, and, with the flexible couplings contemplated for the purpose, the recharging of a car with power need not occupy more than a minute or two. The same is true as to recharging with hot water, and the two can be done at the same time. The temperature of the hot water tank, covered with asbestos, on the occasion of the trial, was reduced from 310° to about 200° in one working hour. Under more favorable conditions, especially in summer, this reduction would be much less, probably not more than half as much.

The Hardie motor and car are hung on elliptic springs, and the ease with which the car passes over wide joints, frogs or imperfections in the track is something admirable. This very important feature attracted the attention and favorable comment of the inspecting visitors from the East, all of whom know too well the terrible pounding that the trolley car gives the railroad track, because, like the lumber wagon, it is absolutely without springs. In this respect the Hardie motor indicates a sure and great saving in wear of rails and cars, while affording the utmost ease to passengers riding.

The principles of the Hardie compressed air motor are apparently above criticism. In the initial machine there are one or two minor respects—one the escape of vapor on a cold day, like the breathing of a horse—in which the motor will be improved, without any difficulty, until the car shall appear as a noiseless, breathless vehicle that glides over the iron rails more smoothly than any heretofore produced, while under the most perfect control in starting and stopping.

The visitors were very much pleased with what they saw of the Hardie motor, and they watched and inspected and tallied it very thoroughly. As a result of their visit they have negotiated for the construction of six to ten of the motors to be used on Eastern lines. The order is upon certain condition, one of which is the introduction of Pintsch gas light into the cars. This, Mr. Hardie says, can easily be done, and any other mechanical requirements can easily be met.

The air motor can be used on the simplest kind of a track. No trolleys or cables are necessary, and the great expense of overhead or underground fixtures and the cost of great power plants are avoided. Besides, the economy of compressed air is greater than any other power. In electricity 60 per cent. is lost; in compressed air but 20 per cent. An equipped street railway that for air motors might cost $10,000 a mile would cost many times that amount for any other system.

Steel Tubes by Mannesmann Process.

Speaking of the Mannesmann process for rolling steel tubes, President Morton, of the Stevens Institute of Technology, says that this is the most remarkable discovery in mechanics since that involved in the Giffard injector. By this process a hot steel billet is passed in between two conical rolls set with their axes at a small angle to each other, and comes out on the other side as a tube with uniform walls, without the use of a mandrel or anything else to make the central opening. This process in fact realizes the familiar Hibernian description of the means of making a cannon: "You take a hole and cast metal around it." In the Mannesmann process it seems as if a hole were taken to serve as a mandrel, and the steel were rolled on it into a tube. So far as the process admits of a popular explanation, the following would seem to be the best that can be given: If a uniform bar of steel be stretched lengthwise it will gradually thin down, by the yielding of the surface layers, until it breaks. If, however, the bar be much harder on its surface than in its interior, then the interior layers or substance will yield first, developing a cavity along the axis of the bar.

It may be supposed that the first effect of the rolls on the hot billet is to harden its surface and then the elongating strain causes a parting of the interior portions and the formation of a tube. Tubes made in this way, from the size of a knitting needle to a diameter of 10 inches, were exhibited at Chicago in 1893. If a billet is drawn down beforehand at its ends and at one or more points in its length, to the diameter which it would have after passing the rolls, the result would be to produce a tube closed at both ends and wherever else the billet was drawn down. The tube in this case must be vacuous except so far as it may contain gases extracted from the steel during the rolling process.

The Market for Gas Securities.

All city gas shares were strong during the week, sales having been made in Consolidated on the Exchange yesterday (Thursday) at 134. Quite something was done in the stock during the week, and every indication is in the direction of higher prices. There is no possible chance of a rate bill passing the Legislature—although we gave this information weeks ago—and the fear that the increase in the price of naphtha by the Standard Oil Company will cut into the profits of the gas companies is all nonsense. The fact is that the greatest increase in selling rates of oil is sure to apply to kerosenes, and the margin of economy between gas illumination and oil illumination in all the large cities has been so slight in favor of the latter, even at the low prices at which kerosenes have been ruling, that an increase of 4 cents per gallon will turn the scale in favor of gas. So, that if enriching naphthas are higher the gas man will more than make the difference by an increased output. Other city gas shares are strong, notably Standard of both classes. Brooklyn securities show no change, unless Nassau be excepted, which is quoted well in excess of 200. The Chicago current dividend is 1 per cent. for the quarter, and is payable on the 25th. It is understood that this means putting the stock on a 5 per cent. basis, and that the next payment to be made will be one of 2½ per cent., October next. This also means semi-annual instead of quarterly returns. The stock is fairly steady, at 72⅛ to 72¼. Bay State securities are still very much depressed, and Laclede show no particular change.

Gas Stocks.

Quotations by Close & Nash, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

APRIL 15.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	133	134
Central	500,000	50	140	..
" Scrip	220,000	..	100	102
Equitable	4,000,000	100	184	..
Bonds, 6's	1,000,000	1,000	105	107½
" 1st Con. 5's	2,300,000	..	112¾	..
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	155	158
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	..	..	.
Northern	150,000	50	.	..
" Bonds	150,000	..	93	98
New York and East River	5,000,000	100	21	23
Preferred	2,000,000	100	40	43
Bonds	3,500,000	1,000	83½	84½
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	..	..	..
Standard	5,000,000	100	44	48
Preferred	5,000,000	100	98	100
Bonds, 1st Mortgage, 5's	1,500,000	..	103½	105
Yonkers	.....	50	112	.
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	..
Citizens	1,200,000	20	65	..
" S. F. Bonds	320,000	1,000	..	101
Equity	2,000,000	10	..	..
" Bonds	1,000,000	..	..	..
Fulton-Municipal	3,000,000	100	175	..
" Bonds	300,000	..	103	..
Peoples	1,000,000	10	90	.
" Bonds, 7's	308,000	..	100	..
" " 6's	94,000	..	98	100
Metropolitan	870,000	100	170	..
" Bonds, 5's	70,000	..	..	..
Nassau	1,000,000	25	200	..
" Ctfs.	700,000	1,000	99	100
Williamsburgh	1,000,000	50	200	..
" Bonds	1,000,000	..	107	110

Out-of-Town Companies.				
Bay State	5,000,000	15	14½	15
" Income Bonds	2,000,000	1,000	19½	20
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	73	75
2d " " "	3,000,000	1,000	48	50
Buffalo Mutual	750,000	100	120	..
" Bonds	200,000	1,000	95	100
Chicago Gas Co.	25,000,000	1,000	72¼	72¾
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	93	93½
Columbus	1,069,000	..	..	..
1st Mortgage	1,085,000	..	..	..
Consumers, Jersey City	2,000,000	100	72	77
" Bonds	600,000	1,000	93	96
Cincinnati G. & C. Co.	7,000,000	100	..	203¾
Consumers, Toronto	1,600,000	50	184½	187
Central, San Francisco	.....	..	90	100
Capital, Sacramento	.....	..	..	50
Consolidated, Baltimore	11,000,000	100	61¾	62
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	18	..
" Con. Bonds	4,312,000	..	..	..
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	76	78
" Bonds	2,000,000	..	84½	85½
Hartford	750,000	25	120	128
Indianapolis	2,000,000	..	144	148
" Bonds, 6's	2,650,000	..	103	..
Jersey City	750,000	20	195	..
Lafayette Gas Co., Ind	1,000,000	100	86	88½
Bonds	1,000,000	1,000	90	91½
Louisville	2,570,000	50	..	130
Laclede, St. Louis	7,500,000	100	25½	27
Preferred	2,500,000	100	82	85
Bonds	9,034,400	1,000	93	93¼
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	208
New Haven	.....	25	200	..
Oakland, Cal.	.....	..	42⅝	43
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	2,100,000	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	165	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	81	..
Bonds, 6's	.....	..	..	..
Consolidated 5's	2,000,000	..	..	..
Syracuse, N. Y.	500,000	25	..	..
San Francisco, Cal.	10,000,000	100	73⅝	73¾
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	46½	47½
Bonds, 5's	3,556,000	..	83½	..
Wilmington, Del.	500,000	50	188	190

Advertisers' Index.

GAS ENGINEERS.

	Page
Jos. R. Thomas, New York City	556
Wm. Henry White, New York City	555
Fred. Bredel, Milwaukee, Wis.	551
H. C. Slaney, Brooklyn, N. Y.	555
Geo. R. Rowland, New York City	555
The Western Gas Construction Co., Fort Wayne, Ind.	546
Humphreys & Glasgow, New York City	542
T. G. Lansden, St. Louis, Mo.	555
David Leavitt Hough, New York City	536

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md.	548
United Gas Improvement Co., Phila., Pa.	545
Burdett Loomis, Hartford, Conn.	554
National Gas and Water Co., Chicago, Ills.	547
Economical Gas Apparatus Construct'n Co., Toronto, Ont	559
The Western Gas Construction Co., Fort Wayne, Ind.	546
A. M. Sutherland, New York City	539

GAS WORKS APPARATUS AND CONSTRUCTION.

James R. Floyd & Sons, New York City	556
Continental Iron Works, Brooklyn, N. Y.	554
Deily & Fowler, Phila., Pa.	556
Kerr Murray Mfg. Co., Fort Wayne, Ind.	552
Stacey Mfg. Co., Cincinnati, Ohio.	555
Bartlett, Hayward & Co., Baltimore, Md.	553
Davis and Farnum Mfg. Co., Waltham, Mass.	552
R. D. Wood & Co., Phila., Pa.	554
Isbell-Porter Company, New York City	554
Fred. Bredel, Milwaukee, Wis.	551
United Gas Improvement Co., Phila., Pa.	545
Berlin Iron Bridge Co., East Berlin, Conn.	542
National Gas and Water Co., Chicago, Ills.	547
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	559
The Western Gas Construction Co., Fort Wayne, Ind.	546
Humphreys & Glasgow, New York City	542
Gas Engineering Co., Pittsburgh, Pa.	539

SCRUBBERS AND CONDENSERS.

G. Shepard Page's Sons, New York City	555
R. D. Wood & Co., Phila., Pa.	554
James R. Floyd & Sons, New York City	556
Continental Iron Works, Brooklyn, N. Y.	554
Gas Engineering Co., Pittsburgh, Pa.	539

REGENERATIVE FURNACES.

Bartlett, Hayward & Co., Baltimore, Md.	553
Fred. Bredel, Milwaukee, Wis.	551
J. H. Gautier & Co., Jersey City, N. J.	551
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.	550
Adam Weber, New York City	550

TAR AND CARBONIC ACID EXTRACTOR.

G. Shepard Page's Sons, New York City	555

AMMONIA CONCENTRATORS.

Michigan Ammonia Works, Detroit, Mich.	536
G. Shepard Page's Sons, New York City	555
Gas Engineering Co., Pittsburgh, Pa.	539

GAS METERS.

John J. Griffin & Co., Phila., Pa.	520
American Meter Co., New York and Philadelphia	559
The Goodwin Meter Co., Phila., Pa.	558
Helme & McIlhenny, Phila., Pa.	560
D. McDonald & Co., Albany, N.Y.	550
Nathaniel Tufts, Boston, Mass.	558
Maryland Meter and Mfg. Co., Baltimore, Md.	558
Harris Bros. & Co., Phila., Pa.	558
Metric Metal Co., Erie, Pa	557

GAS AND WATER PIPES.

Ohio Pipe Co., Columbus, Ohio	557
M. J. Drummond, New York City	557
R. D. Wood & Co., Phila., Pa.	554
Warren Foundry and Machine Co., New York City	557
Donaldson Iron Co., Emaus, Pa.	557
Addyston Pipe and Steel Co., Cincinnati, O.	556
John Fox, New York City	557

STEAM BLOWER FOR BURNING BREEZE.

H. E. Parson, New York City	551

GAS COALS.

Penn Gas Coal Co., Phila., Pa.	549
Perkins & Co., New York City	548
Despard Gas Coal Co., Baltimore, Md.	549
Westmoreland Coal Co., Phila., Pa.	549
Shaner Coal Co., Philadelphia, Pa.	536
Berwind-White Coal Mining Co., New York and Phila.	526

CANNEL COALS.

Perkins & Co., New York City	548
Log Mountain Coal, Coke and Timber Co., Pineville, Ky.	549

GAS ENRICHERS.

Standard Oil Co., New York City	549
The Sun Oil Co., Pittsburgh, Pa.	549
W. H. Townsend, New York City	549

COKE CRUSHER.

C. M. Keller, Columbus, Ind.	549

CONVEYING MACHINERY.

C. W. Hunt Company, N. Y. City	526

GAS GAUGES.

The Bristol Co., Waterbury, Conn.	551

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City.	547
Wilbraham Baker Blower Co., Phila., Pa.	547
Isbell-Porter Co., New York City	554

SELF-SEALING MOUTHPIECE DOORS.

Isbell-Porter Company, New York City	554
Continental Iron Works, Brooklyn, N. Y.	554
G. Shepard Page's Sons, New York City	555

RETORTS AND FIREBRICK.

J. H. Gautier & Co., Jersey City, N. J.	550
B. Kreischer & Sons, New York City	550
Adam Weber, New York City	550
Laclede Firebrick Mfg. Co., St. Louis, Mo.	550
Cyrus Borgner, Phila., Pa	550
James Gardner, Jr., Pittsburgh, Pa.	550
Henry Maurer & Son, New York City	550
Baltimore Retort and Firebrick Co., Baltimore, Md.	550
Parker-Russell Mining and Mfg. Co., St. Louis, Mo.	550
Brooklyn Firebrick Works, Brooklyn, N. Y.	550
F. Behrend, New York City	540

CEMENTS.

C. L. Gerould & Co., Mount Vernon, N. Y.	550
F. Behrend, New York City	540

INCANDESCENT GAS LAMPS.

Welsbach Light Co., Gloucester, N. J.	539

BURNERS.

C. A. Gefrorer, Phila., Pa.	554
Moses G. Wilder, Phila., Pa.	536

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn.	526

GAS TUBING.

New York Gas Tubing Co., New York City	536

STREET LAMPS.

J. G. Miner, Morrisania, New York City	551
Bartlett Lamp Mfg. Co., New York City	551

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City	547
Greenpoint Chemical Works, Brooklyn, N. Y.	547
Henry W. Douglas, Ann Arbor, Mich.	547
Read, Holliday & Sons, Ltd., New York City	540

EXHAUSTERS.

The P. H. & F. M. Roots Co., Connersville, Ind.	544
Isbell-Porter Company, New York City	554
Wilbraham Baker Blower Co., Philadelphia, Pa.	547
Connelly Iron Sponge and Governor Co., New York City	547

VALVES.

Ludlow Valve Manufacturing Co., Troy, N.Y.	546
Chapman Valve Manufacturing Co., Boston, Mass.	546
R. D. Wood & Co., Phila., Pa.	554
Continental Iron Works, Brooklyn, N. Y.	554
John Fox, New York City	557
The P. H. & F. M. Roots Co., Connersville, Ind.	544
Isbell-Porter Co., New York City	554
The Western Gas Construction Co., Fort Wayne, Ind	546

ELECTRICAL APPARATUS.

Wm. Henry White, New York City	555

GAS ENGINES.

Otto Gas Engine Works, Phila., Pa.	560
The American Gas Engine Co., Phila., Pa.	537

ENGINES AND BOILERS.

The Hazelton Boiler Co., New York City	540

PURIFIER SCREENS.

John Cabot, New York City	551

GAS STOVES.

American Meter Co., New York and Philadelphia.	543
The Goodwin Meter Co., Phila., Pa.	558
George M. Clark & Co., Chicago, Ills.	541
Maryland Meter and Manufacturing Co., Baltimore, Md.	558
The Schneider & Trenkamp Co., Cleveland, O.	540
William M. Crane & Co., New York City	541

CHINA GAS KILNS.

F. A. Wilke, Richmond, Ind.	556
William M. Crane & Co., New York City	541

GAS FLOW COMPUTERS.

Wm. Cox, Stapleton, N. Y.	553

COIN WRAPPERS.

Alvord & Co., Detroit, Mich.	456

GASHOLDER PAINT.

The Government Waterproof Paint Co., Boston, Mass.	546
New York Marine Paint Co., Poughkeepsie, N.Y.	546

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N. Y.	551

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md.	553
Continental Iron Works, Brooklyn, N. Y.	554
Deily & Fowler, Philadelphia, Pa.	556
Davis & Farnum Mfg. Co., Waltham, Mass.	552
Kerr Murray Mfg. Co., Fort Wayne, Ind.	552
Stacey Mfg. Co., Cincinnati, Ohio.	555
R. D. Wood & Co., Philadelphia, Pa.	554

WANTED,

A 5 or 6 Foot Station Meter.

Address, with price and condition,

WINONA GAS LIGHT CO.,

1035-2 Winona, Minn.

Situation Desired

By a Man who has had a Large Experience in the Manufacture of Both Coal and Water Gas.

Can give the best of references. Address

1033-tf "W. H. S.," care this Journal.

WANTED,

By a man who has had a round experience in the manufacture and sale of gas,

A Position as Supt. of a Large or Smal' Gas Works.

Is capable and energetic, and is willing to begin at a moderate salary. Address

1032-tf "B.," care this Journal.

FOR SALE,

Two Second-Hand Purifiers,

10 ft. by 15 ft. by 3 ft., 24-inch Cups, with Center Seal and Connections, all in good condition. Address

1036-tf "PURIFIER," care this Journal.

WANTED,

A SMALL GAS ENGINE,

not over one-third horse power, to drive coffee mill in window. Address

1035-2 ROBT. MILLER, Cumberland, Md.

Coal Tar For Sale.

The Cumberland (Md.) Gas Light Company will receive bids for their Coal Tar Production for twelve months, dating from May 1st, 1895. Process, all coal from W. Va. mines. Production, about 400 barrels. Put up in barrels of 50 gallons, f.o.b. cars, Cumberland, Md.

CUMBERLAND GAS LIGHT CO.,
1035-2 Cumberland, Md.

DAVID LEAVITT HOUGH,

19 W. 31st St., N. Y. City.

Investment Property Appraiser, Consulting and Contracting Engineer.

GAS, WATER, STREET RAILWAY AND FIREPROOF STRUCTURAL WORK.

Extensions to Existing Gas Plants and Initial Plants Designed. Bids obtained, checked and tabulated, ready for Board or Committtee meetings. *Work followed at the Shops to secure Proper Attention and Speed, and Inspected during Erection.*

MOSES G. WILDER,

Mechanical Engineer,

816-822 Cherry St., Phila., Pa.

MANUFACTURER OF

Gas Governors,

Governor Gas Burners,

Gas Cocks and Fittings,

In addition to a full assortment of Volumetric Governors, etc, I am now making **MERCURY PRESSURE GOVERNORS** of all the usual sizes, adapted to use upon *Gas Stoves, Furnaces, and Meters*. The same careful attention to details of design and workmanship which has established the reputation of **WILDER'S VOLUMETRIC GOVERNORS** will be given to the new line. They have been thoroughly tested in many places during the past year, and have given entire satisfaction. The price is very low, and but for a complete system of machinery adapted to this work, it would be impossible to sell them at the price. I hope for large orders, as they become known, in consequence of the low price and good quality.

Electrolysis Prevented

Gas Pipes and Water Pipes Protected from Corrosion of Electric Railway Currents by Patented Process.

IN USE AT NEWARK, N. J.

HAROLD P. BROWN, Electrical Expert,

Edison Building, New York.

Correspondence solicited from City Officials and Managers of Gas Works, Water Works, and Electric Railways. Refers to Thomas A. Edison, Orange, N. J.; F. S. Pearson, Chief Engr. Metropolitan Traction Co., N. Y.; David Young, Gen'l Mangr. Consolidated Traction Co., Jersey City; Harrison Van Duyne, Prest. Board of Works, Newark, N. J.; Newark City Gas Co., Newark, N. J. 1023-13

Utilize Your Gas Liquor.

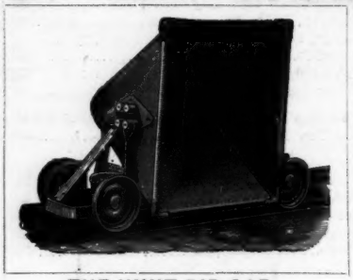
NO EXTRA LABOR OR OPERATING EXPENSES.

Ammonia Concentrator,

Not Expensive. Write to

STROH & OSIUS, Pat'ees, or Mich. Ammonia Works, Detroit, Mich.

G. W. HUNT COMPANY.



THE HUNT TIP CAR.

COKE CARS for Gas Works,
TIP CARS for Carrying Ashes,
CHARGING CARS for Bringing Coal from the Storage Bins to Boiler Room and Retort Houses.

INDUSTRIAL RAILWAYS

Specially designed for handling material in and around

Gas Works, Coal Yards, Factories, Etc, Etc.

45 BROADWAY, - - NEW YORK.

Patent Lava Gas Tips.

UNIFORMITY GUARANTEED.

ALL SIZES AND SHAPES.

D. M. STEWARD MFG. CO.,
CHATTANOOGA, TENN.

If You Want the Best GAS-TIGHT Tubing,

BUY OF THE

NEW YORK GAS TUBING CO.

334 & 336 East 23d St., N. Y.

GUARANTEED NOT TO STIFFEN. Makers of All Kinds of Flexible Tubing.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Gas Coal.

***

Offices:

55 Broadway, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully prepared.
For Gas Making or
Heavy Steaming.

The Celebrated SHANER GAS COAL

CORRESPONDENCE SOLICITED.

Is Mined and Shipped from the Best Gas Coal Basin in Pennsylvania.

SHANER COAL CO., - 1326 Chestnut Street, Philadelphia.

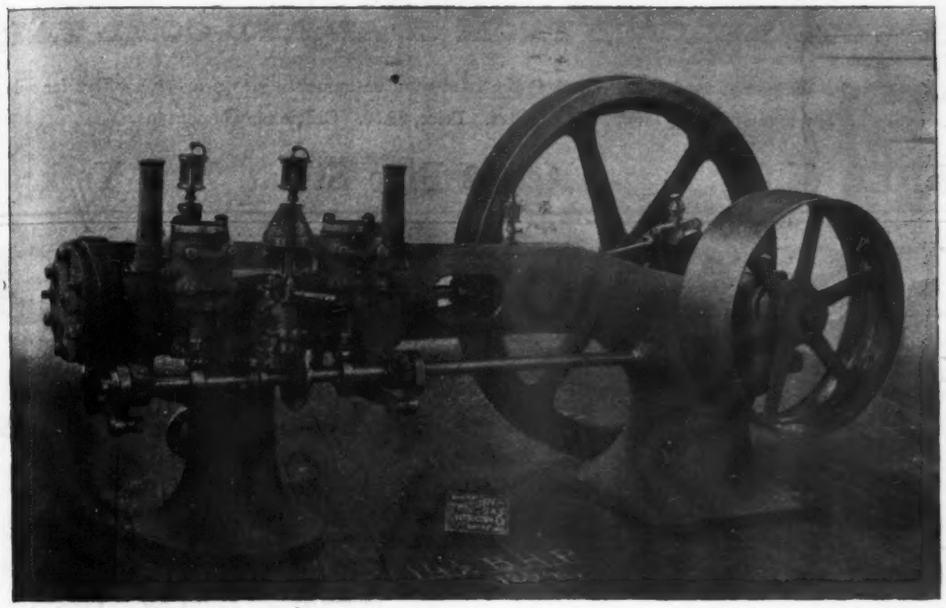
WM. W. GOODWIN, Prest. O. N. GULDLIN, V.-Prest. & Treas. H. B. GOODWIN, Sec. EARNEST F. LLOYD, Asst. Sec

THE AMERICAN GAS ENGINE CO.,

MANUFACTURERS OF

The Double-Acting Gas Engine,

Under the Patents of Griffin, and Dick, Kerr & Co., of London and Kilmarnock.



***

Single Cylinder.

Impulse Every Revolution.

(Two Strokes.)

15 to 500 Horse Power.

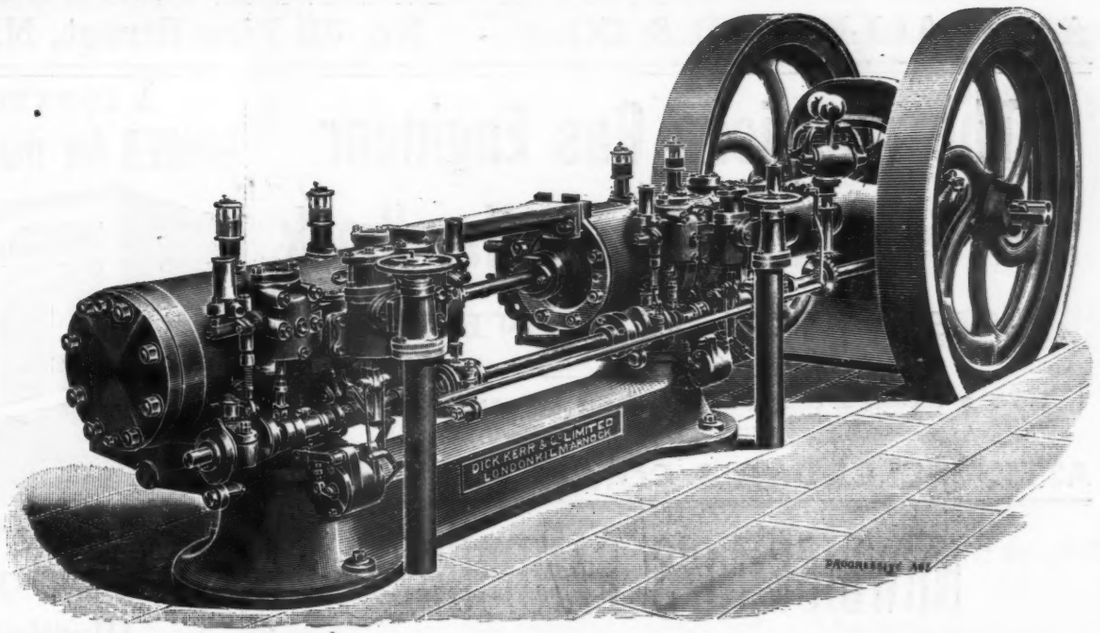
For General Work and Isolated Electric Plants.

***

Tandem Cylinder. Impulse Every Stroke.

100 to 1,000 Horse Power.

For Central Stations and all work requiring extreme steadiness.



ESSENTIAL PRINCIPLE.—An impulse at each end of piston; using half force to each impulse; doubling the steadiness; reducing the wear on moving parts, and weight for given power. **CONSTRUCTION.**—The piston rod works through stuffing box in front end of cylinder, and connecting rod is carried in a cross-head working in a slide in frame, as in ordinary steam engine practice. All valves are of the poppet type, operated by cams on a single cam-shaft, giving positive movement to every working part. Tube or electric ignition. **RESULT.**—An engine of extreme simplicity and steadiness of action, the even wear on the cylinder aud all working parts assuring increased economy, long life, and minimum cost in repairs. **RECORD.**—Successful and constant use in Great Britain for the past eight years. Address

W. W. GOODWIN, President, Lock Box 718, Philadelphia, Pa.., or
THE WESTERN GAS CONSTRUCTION CO., Bldrs. & Gen. Agts., Fort Wayne, Ind.

Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng.,

Having compiled a novel Chart or Map illustrating the various

CHEMICAL PRODUCTS DERIVED FROM COAL AND COAL TAR,

In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

FIELD'S ANALYSIS

For the Year 1893.

An Analysis of the Accounts of the Principal Gas Undertakings in England, Scotland, and Ireland. Being the Twenty-third Year of Publication. Compiled and Arranged by

JOHN W. FIELD Accountant to the Gas Lt. and Coke Co., London.

Price, $5. For Sale by

A. M. CALLENDER & CO., - No. 32 Pine Street, N. Y. City.

The American Gas Engineer and Superintendent's Handbook.

By WM. MOONEY.

350 Pages, Full Gilt Morocco. Price. $3.00.

A. M. CALLENDER & CO., 32 Pine St., N. Y

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text and much of it has been rewritten and otherwise improved.

Price, Cloth, $6.

A. M. CALLENDER & CO., 32 Pine St., N. Y.

A CONVENIENT

BINDER for the JOURNAL

STRONG.
DURABLE.
LIGHT.
SIMPLE
CHEAP.
HANDSOME.
Price, $1.

A.M. Callender & Co., 32 Pine st., N. Y. City.

The Chemistry of Illuminating Gas.

By NORTON H. HUMPHRYS. Price, $2.40.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

Management of Small Gas Works.

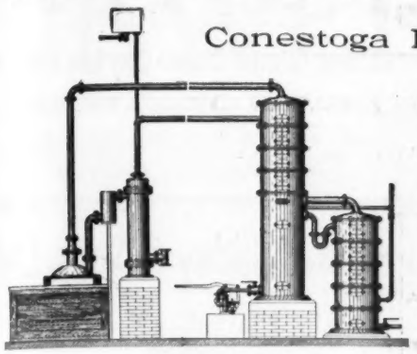
By C. J. R. HUMPHREYS. Price, $1.

A. M. CALLENDER & CO., 32 PINE ST., N. Y. CITY.

GAS ENGINEERING COMPANY,

INCORPORATED,

Conestoga Building, PITTSBURGH, PA.



AMMONIA MACHINE.

MANUFACTURERS OF

Gas Works Machinery of all kinds,

PATENTEE AND OWNER OF

PITTSBURGH WASHER-SCRUBBER,

SOLE AGENT FOR

FELDMANN AMMONIA MACHINE,

For producing Sulphate, Aqua, Chloride and Concentrated Liquors.

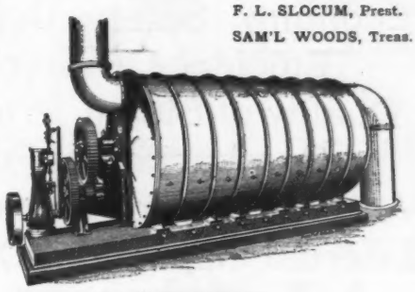
The Erection of Bi-Product Coke Ovens a Specialty.

Faux System of Recuperative Benches,

JAS. GARDNER, JR.
SOLE CONSTRUCTOR AND BUILDER.

NEW SYSTEM HYDRAULIC MAIN.

F. L. SLOCUM, Prest.
SAM'L WOODS, Treas.



SCRUBBER.

THE LITTLE GIANT (AN IMPROVEMENT ON THE LOWE) GENERATOR.

Can be put into Coal Gas Works at a price the interest on which will not be so much as their present repair account.

This Generator is now in use in nearly every State in the Union, and everyone using it will recommend it to you.

It makes a faultless gas from whatever gas-producing materials are cheapest in the locality where required, using hard coal or coke in connection with Lima crude or any other crude petroleum or its distillates, including *Naphtha of any specific gravity.*

I build these Generators with any required capacity, from 3,000 cubic feet per hour upward.

In more than one half the gas works in the country the "Little Giant" will enable *one man* to easily make, in *five hours*, all the gas needed for the *twenty-four hours.*

Why struggle day and night, year after year, with high priced, low candle Coal Gas; with choked standpipes, broken retorts, naphthaline, and interminable other troubles and delays, while it is so easy to make an entirely better gas for less money in a quarter of the time, and having none of these drawbacks?

If gas coal is very cheap and anthracite coal and hard coke very expensive with you, put in a Little Giant Generator, as many others have done, *to increase candle power, to use up your surplus coke, and to rush up your holder when hard pressed.*

All work and results guaranteed.

A. M. SUTHERLAND, - - - No. 136 Liberty Street, N. Y. City.

THE GAS APPLIANCE EXCHANGE,
20 S. Fifteenth Street,
Philadelphia, Dec. 28th, 1894.

To COL. W. E. BARROWS, G. M., Welsbach Light Co., Gloucester, N. J.:

Dear Sir—Owing to the severe storm of Wednesday night, which did so much damage to telegraph, telephone and electric light property in the City, I considered it would be well to examine the Welsbach lights in Rittenhouse Square. I therefore sent a man to make a critical examination of the lights, after they had been lighted the following night. It gives me great pleasure to state that of the 48 lights in the Square, not one was out of order or required repairing, all of them being in perfect condition, and showing no sign of being affected by the storm.

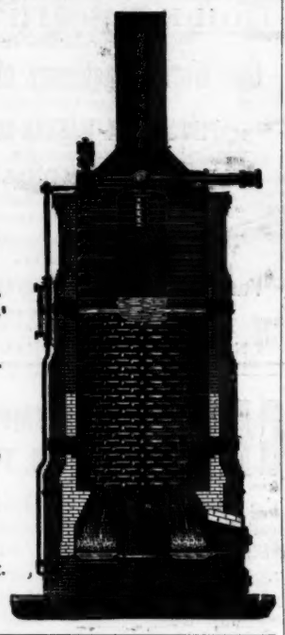
Very truly yours,

R. J. ROLSTON, Superintendent.

THE HAZELTON OR PORCUPINE BOILER.

Is Superior to All Others in

Economy, Safety, Durability,
Efficiency, Capacity,
Quality of Steam Produced,
Combustion of Fuel,
Accessibility for Internal and
External Inspection and Cleaning.



SEND FOR CATALOGUE AND REPORTS OF TESTS.

CORRESPONDENCE SOLICITED.

THE HAZELTON BOILER CO.,
Sole Proprietors and Manufacturers,
No. 716 East 13th Street, New York, U. S. A.

Cable Address, "PAILA," New York.
Long Distance Telephone, 1229–18th St., New York.

Not Connected with any other Concern in the U.S.

F. BEHREND,
SOLE IMPORTER OF THE CELEBRATED
German (Stettin-Didier) Clay Gas Retorts,
BLOCKS, TILES, FIREBRICKS, FIRE CEMENT,
Stettin "Anchor" & "Eagle" Brand Portland Cement
10 & 12 Old Slip, New York.

Read, Holliday & Sons, Ltd.
No. 7 Platt St., N. Y. City.

HYDRATED OXIDE OF IRON
For Gas Purification.
Analysis, Samples and Particulars on Application.

THE CHEMISTRY OF ILLUMINATING GAS.
By NORTON H. HUMPHRYS. Price, $2.40.
Orders may be sent to
A. M. CALLENDER & CO., No. 32 Pine Street, New York City.

PATENTS
Promptly secured. Trade-Marks, Copyrights and Labels registered. Twenty-five years experience. We report whether patent can be secured or not, free of charge. Our fee not due until patent is allowed. 32 page Book Free.
N. S. WILLSON & CO., Attorneys at Law,
Opp. U.S. Pat. Office. WASHINGTON, D.C.

RELIABLE GAS STOVES AND RANGES

By all odds the most Complete Line manufactured under one name, comprising all known Styles and Sizes.

More desirable improvements made in the **Reliable** line for 1895 than in all makes combined for the past ten years.

In addition to the many improvements, we have also added a complete new line of

High Grade Ranges,

swelling the **Reliable** line for 1895 to six distinct and separate lines of Ranges and three lines of Hot Plates, making in all

126 Sizes and 252 Styles, Ranging in Price form $2 to $84.

All the valuable improvements we have added for the coming season will give the **"Reliable"** a prestige as the leading line of Gas Ranges, and, being such a good thing, will undoubtedly be pushed along by others in 1896.

You will always find the **Reliable** line at least three years in advance of all competitors.

THE SCHNEIDER & TRENKAMP COMPANY, Sole Manufacturers,

Send for our 1895 Gas Catalogue. It cannot fail to Interest you.

Cleveland, O., and Chicago, Ill.

JEWEL GAS STOVES

This is One of Eight New Ranges.

For 1895

ARE MODERN

AND

UP TO DATE.

Two New Laundry Stoves.

Six New Square Junior Stoves.

WRITE FOR 1895 CATALOG.

56 Cooking Appliances.
Not a Padded Book.

GEORGE M. CLARK & COMPANY, Makers, CHICAGO.

Eastern Agency, 152 & 154 West 23d St., N. Y. City.

WILLIAM M. CRANE & CO.,

Office, 838 Broadway.
Factory, 428 & 430 W. 14th Street, New York City.

We carry the Most
Complete Line of
Gas Appliances in the
Country.
Gas Fires, Gas Logs,
Fire Place Heaters,
Ranges, Broilers,
Laundry Stoves,

WILLIAM M. CRANE AND CO. VULCAN NEW YORK TRADE MARK.

Tailor Stoves,
Soldering Furnaces,
Griddles,
Waffle Stoves,
Hot Plates,
Gas Kilns, etc., etc.
A Complete New Line
of Ranges for 1895.

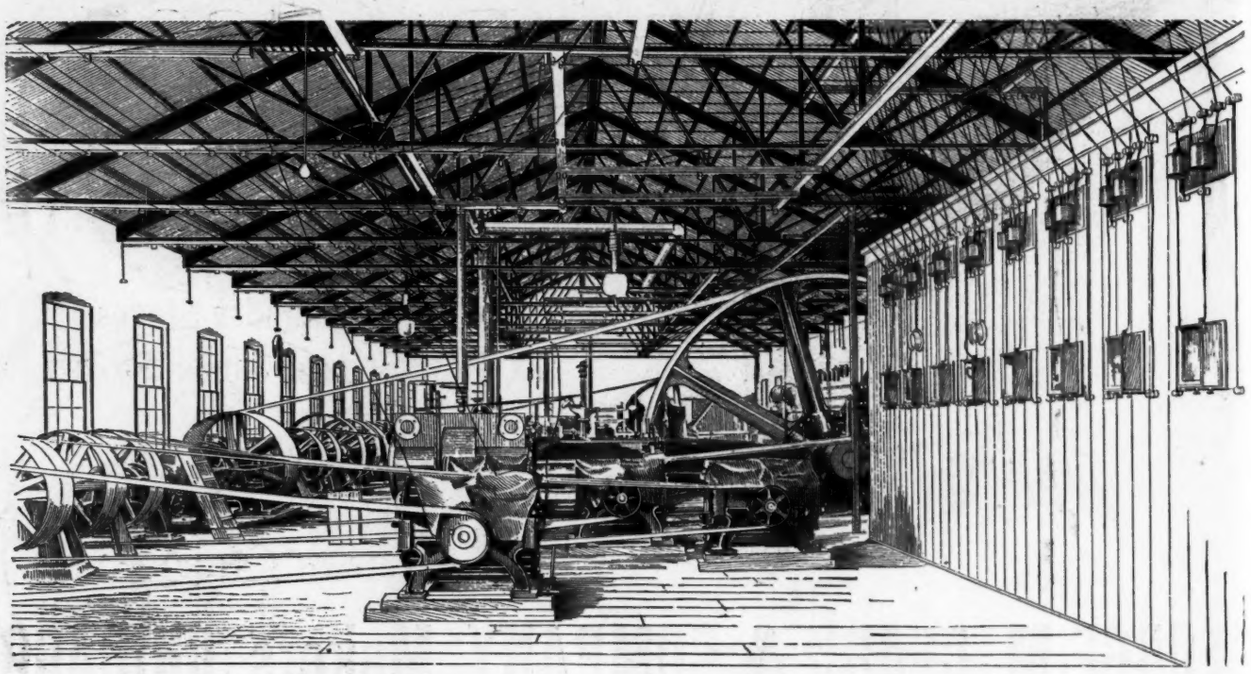
Send for Description of our NEW VULCAN Gas Furnace, for HOT AIR or HOT WATER.

Gas Controllers, Meter and Service Cocks, Independent and Hose Cocks, and Fittings of all kinds, with Extra Large Gas Way.

SEND FOR NEW CATALOGUE. WILL BE ISSUED ABOUT MARCH FIRST.

CHAS. M. JARVIS, Prest. & Chief Engineer. BURR K. FIELD, Vice-President. FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

THE BERLIN IRON BRIDGE CO.



The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Connecticut Electric Company, at Waterbury, Conn. The building is 51 feet in width by 251 feet in length, with brick walls and iron truss roof covered with corrugated iron. For an Electric Light Station, where the risk from fire is very great, this construction particularly commends itself, as this risk is entirely eliminated.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

ALEX. C. HUMPHREYS, M.E.,
MANHATTAN LIFE BUILDING,
(64 BROADWAY,)
NEW YORK.

CABLE ADDRESS,
LONDON & NEW YORK,
"HUMGLAS."

ARTHUR G. GLASGOW, M.E.,
9 VICTORIA ST.,
LONDON, S. W.,
ENGLAND.

HUMPHREYS & GLASGOW,

CONTRACTING AND CONSULTING

GAS ENGINEERS.

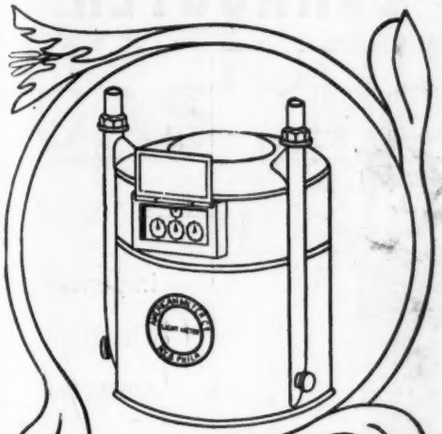
WATER GAS PLANT A SPECIALTY.
GAS PROPERTIES EXAMINED AND VALUED.
ADVICE AS TO IMPROVEMENT OF GAS PROPERTIES AND MANAGEMENT.

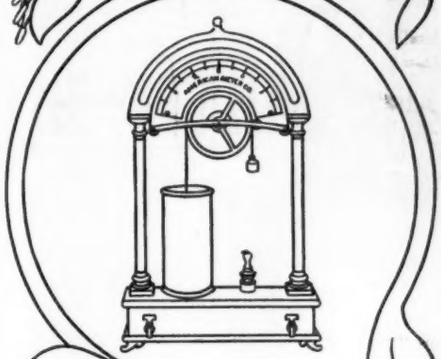
THE MANAGEMENT OF SMALL GAS WORKS.

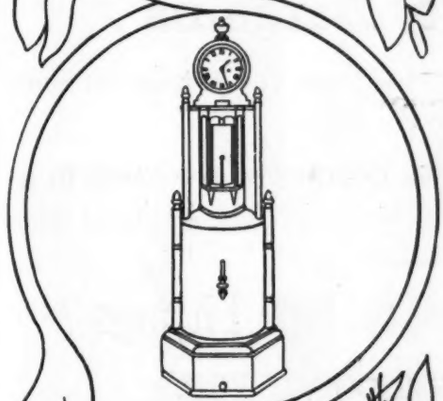
By C. J. R. HUMPHREYS.

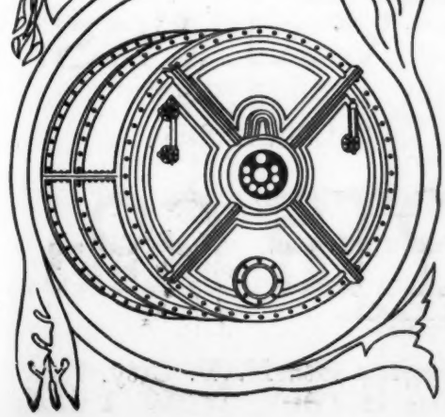
Price $1.

A. M. CALLENDER & CO., No. 32 Pine Street, New York.









(Copyrighted, 1894, by the AMERICAN METER CO.)

AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1868.

NEW YORK AND PHILADELPHIA,
CHICAGO, ST LOUIS,
SAN FRANCISCO.

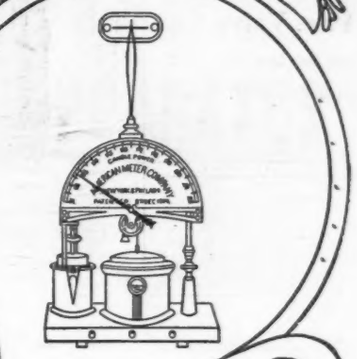
PUBLIC LIGHTING TABLE.

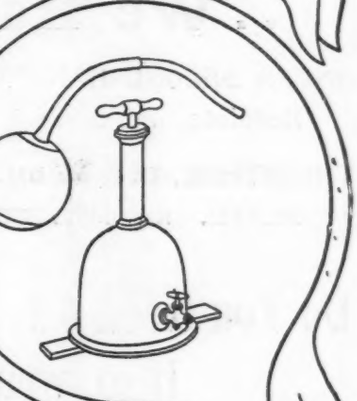
APRIL, 1895.

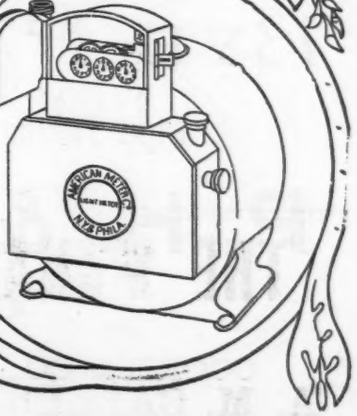
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Mon.	1	12 30 AM	4.40 AM	6.10	4.55
Tue.	2	1.20 FQ	4.40	6.15	4.40
Wed.	3	2.00	4.40	6.15	4.40
Thu.	4	2.40	4.40	6.15	4.40
Fri.	5	3.00	4.40	6.15	4.40
Sat.	6	3.30	4.40	6.15	4.40
Sun.	7	4.00	4.40	6.15	4.40
Mon.	8	No L.	No L.	6.15	4.40
Tue.	9	No L. FM	No L.	6.25	4.30
Wed.	10	No L.	No L.	6.25	4.30
Thu.	11	7.00 PM	10.30 PM	6.25	4.30
Fri.	12	7.00	11.40	6.25	4.30
Sat.	13	7.00	12.40 AM	6.25	4.30
Sun.	14	7.10	1.40	6.25	4.30
Mon.	15	7.10	2.20	6.25	4.30
Tue.	16	7.10 LQ	3.00	6.30	4.20
Wed.	17	7.10	3.30	6.30	4.20
Thu.	18	7.10	4.00	6.30	4.20
Fri.	19	7.10	4.10	6.30	4.20
Sat.	20	7.10	4.10	6.30	4.20
Sun.	21	7.20	4.10	6.30	4.20
Mon.	22	7.20	4.10	6.30	4.20
Tue.	23	7.20	4.10	6.40	4.10
Wed.	24	7.20 NM	4.10	6.40	4.10
Thu.	25	7.20	4.10	6.40	4.10
Fri.	26	7.20	4.10	6.40	4.10
Sat.	27	7.20	4.10	6.40	4.10
Sun.	28	7.20	4.00	6.40	4.10
Mon.	29	11.10	4.00	6.40	4.10
Tue.	30	12.00	4.00	6.45	4.00

TOTAL HOURS LIGHTING DURING 1895.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	237.00	January	423.20
February	196.40	February	355.25
March	195.50	March	355.35
April	165.30	April	298.50
May	153.40	May	264.50
June	138.20	June	234.25
July	146.30	July	243.45
August	152.50	August	280.25
September	165.10	September	321.15
October	186.10	October	374.30
November	204.10	November	401.40
December	219.30	December	433.45
Total, yr.	2161.20	Total, yr.	3987.45

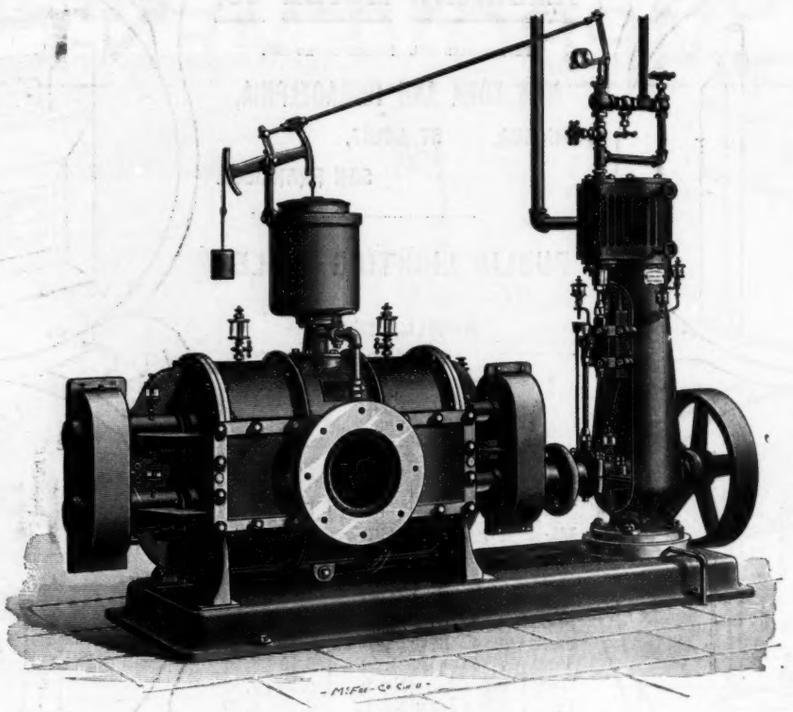






ROOTS' LATEST IMPROVED EXHAUSTER.

Our Latest Improved **Automatic Gas Governor** and **Steam Bye-Pass Valve** are the best in the market.



Inquiries Cheerfully Answered.

Send for Catalogue.

. . We Have For Sale Two Bargains . .

ONE, A SECOND-HAND No. 6 EXHAUSTER, with 12-inch Connections and Engine on same Bedplate, with Governor, etc., complete; run but a short time. Write for price.

THE OTHER, OUR WORLD'S FAIR EXHAUSTER AND ENGINE COMBINED ON SAME BED-PLATE. Run not to exceed one week; size, No. 6. Special prices that will be attractive on either of above.

Do You Need Any Valves, Bye-Pass Valves, or Pipe Fittings?
If so, write us, and see what we can do for you.

BYE-PASS AND GAS VALVES.

Pipe Fittings of all Kinds and Designs to Suit Conditions.

P. H. & F. M. ROOTS CO.,

Connersville, Ind.

COOKE & CO., Selling Agts., 163-165 Washington St., N. Y. City.

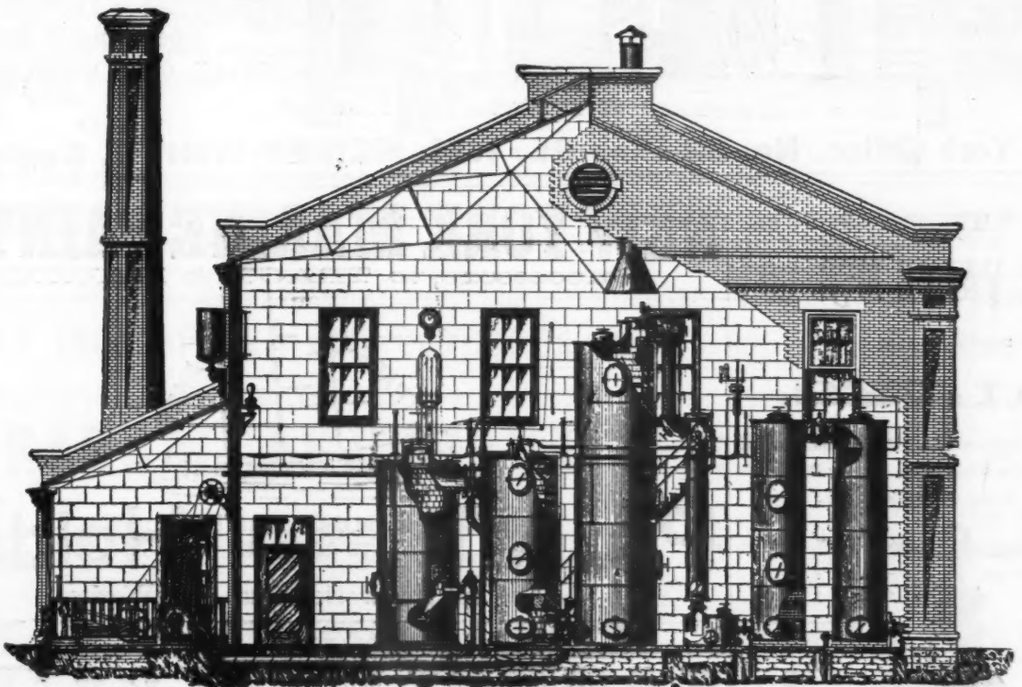
THE UNITED GAS IMPROVEMENT CO.,

DREXEL BUILDING, PHILA., PA.

Inquiries from any part of the United States should be addressed to the Philadelphia Office.

BUILDERS OF

THE STANDARD LOWE WATER GAS APPARATUS.



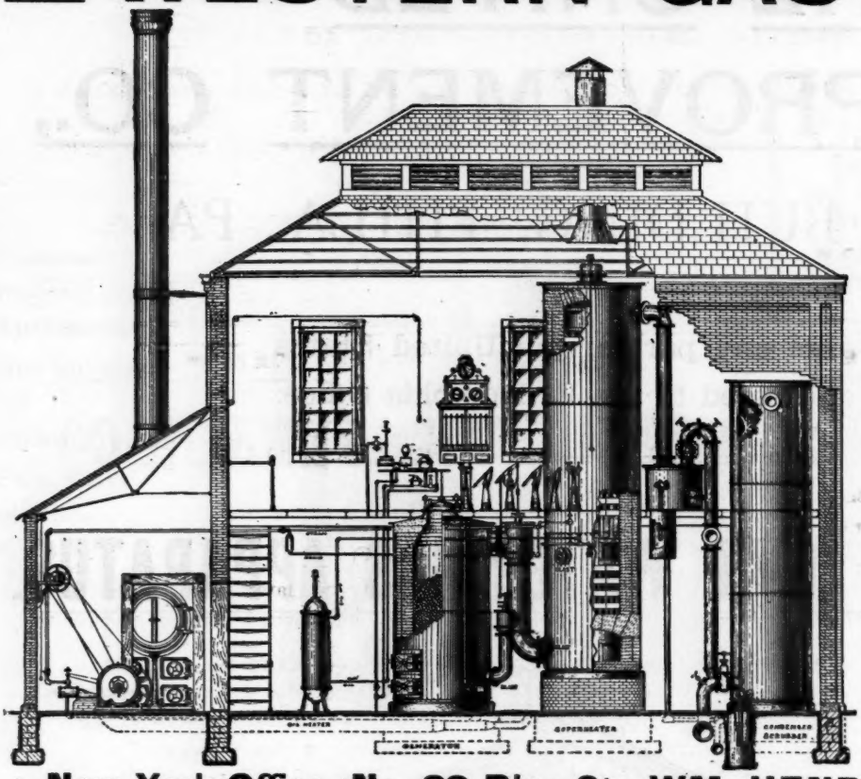
Standard "Double Superheater" Lowe Apparatus, designed for the use of Naphtha, Crude Oil, or "Distillates."

BUILDERS, LESSEES AND PURCHASERS OF GAS WORKS.

Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

PAMPHLETS, PLANS AND ESTIMATES FURNISHED UPON APPLICATION.

THE WESTERN GAS CONSTRUCTION CO.



FORT WAYNE, IND.

Engineers & Builders.

IMPROVED LOWE WATER GAS Apparatus

PURIFIERS,
CONDENSERS,
SCRUBBERS
EXHAUSTERS
CENTER VALVES,
operating 1 to 4 Boxes.
COAL GAS BENCHES,
Etc., Etc.

New York Office, No. 32 Pine St., WM. HENRY WHITE, Engineer.

THE

LUDLOW VALVE MFG. CO.,

MANUFACTURERS OF

VALVES,

Double and Single Gate, ½ in. to 72 in., outside and inside Screws. Indicator, etc., for Gas, Water, Steam, Oil and Ammonia.

SEND FOR CIRCULAR.

SEND FOR CIRCULAR.

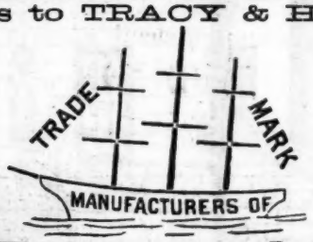
ALSO,

Hydraulic Main Dip Regulators, Check Valves, Foot Valves, Yard Wash and Fire Hydrants.

OFFICE AND WORKS:
938 to 954 River St., & 67 to 83 Vail Av.
TROY, N. Y.

NEW YORK MARINE PAINT CO.

Successors to TRACY & HADDEN.



PAINT PECULIARLY ADAPTED TO STAND ON Holders

And all Ironwork about Gas Works.

POUGHKEEPSIE, N. Y.

GASHOLDER PAINT.

Use Only

THE GOVERNMENT WATERPROOF PAINT.

Proof against Ammonia, and Absolutely Waterproof. Send for Prices and Particulars.

THE GOVERNMENT WATERPROOF PAINT CO. 104 High Street. Boston. Mass.

CHAPMAN VALVE MANUFACTURING CO.,

MANUFACTURERS OF

Valves and Gates for Gas, Ammonia, Water, Etc.

Also, Cate Fire Hydrants with and without Independen Nozzle Valve. All Work Guaranteed.

Works & Gen'l Office, Indian Orchard, Mass, Treasurer's Office, 72 Kilby & 112 Milk Sts., Boston Mass
Chicago Office, 24 West Lake St. New York Office, 28 Platt St.
St. Louis Office, L. M. Rumsey Mfg. Co., 810 North Second St

NATIONAL GAS AND WATER CO.,

218 La Salle St., Chicago, Ill.

IRWIN REW, President and Treasurer. E. E. MORRELL, Vice-President and Engineer. N. A. McCLARY, Secretary and General Manager.

Builder and Operator of Gas Works.

SOLE OWNER OF THE

REW APPARATUS,

FOR THE MANUFACTURE OF CARBURETED WATER GAS DIRECTLY FROM LOW GRADE SOFT COAL AND CRUDE OIL AND NAPHTHA.
A DEMONSTRATED SUCCESS.

SOLE OWNER OF THE

MORRELL APPARATUS,

FOR THE MANUFACTURE OF CARBURETED WATER GAS FROM HARD COAL OR COKE AND CRUDE OIL OR NAPHTHA. A WELL-KNOWN TYPE, SIMPLE, ECONOMICAL AND EFFICIENT.

PLANS AND GUARANTEED ESTIMATES FURNISHED UPON APPLICATION.

CONNELLY IRON SPONGE AND GOVERNOR CO.,

(Successors to CONNELLY & CO.)

MANUFACTURERS OF GAS WORKS SPECIALTIES.

"IRON SPONGE." Saves money, saves labor, and is the most efficient purifying material ever offered as a substitute for lime. We guarantee a large saving, both in cost of material and labor.

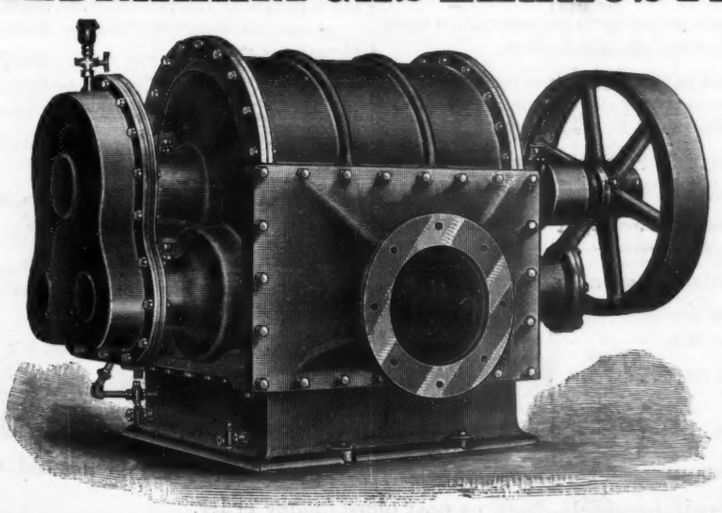
AUTOMATIC GOVERNOR. OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT! WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION; REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE! IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

STEAM JET EXHAUSTER. Designed particularly for small works. Combines Exhaust Tube, Steam Governor, Gas Compensator and Bye-Pass Valves in the most compact form possible. Occupies but little space; uses very little steam; saves formation of carbon in retorts; increases yield 10 to 15 per cent. No works too small to use them profitably.

Prices given on all our specialties, delivered at any point in the United States. Correspondence solicited.

CONNELLY IRON SPONGE AND GOVERNOR CO., No. 365 Canal St., New York.

WILBRAHAM GAS EXHAUSTER



WILBRAHAM BAKER BLOWER COMPANY,

PHILADELPHIA, PA.

IRON MASS

For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

Greenpoint Chemical Works.

JOHN SCHRIEVER, Manager.

Greenpoint Ave. & Newtown Creek, Brooklyn N.Y.

DOUGLAS' FERRIC OXIDE

For Gas Purification

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West

Full information, with references to many users, and prices delivered in any locality, furnished on application to

H.W. Douglas (Supt. Ann Arbor Gas Company) **Ann Arbor, Mich.**

JAMES D. PERKINS. **PERKINS & CO.,** F. SEAVERNS.

228 & 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING

Standard Gas Coals and Cannel:

Ocean Mine Youghiogheny Gas Coal,

Clinch Valley Gas Coal, and the

Old Kentucky Shale, for Enriching Purposes.

Cargo Shipments from New York, Philadelphia, Baltimore and Norfolk.

Single carloads or more delivered at any required point in the United States or Canada.

SCIENTIFIC BOOKS.

ING'S TREATISE ON THE MANUFACTURE OF COAL GAS. Three vols.; $10 per vol.

GAS MANUFACTURE, by WILLIAM RICHARDS. 4to., with numerous Engravings and Plates, in Cloth binding. $12.

TECHNICAL GAS ANALYSIS. $3.

GAS CONSUMER'S GUIDE. $1.

GAS CONSUMER'S HANDBOOK, by WILLIAM RICHARDS, C.E.; 18mo., Sewed. 20 cents.

A PRACTICAL TREATISE ON GAS AND VENTILATION with Special Relation to Illuminating, Heating, and Cooking by Gas, by E. E. PERKINS. $1.25.

CHEMISTRY OF ILLUMINATING GAS, by NORTON H. HUMPHRYS. $2.40.

PRACTICAL TREATISE ON HEAT, by THOMAS BOX. Second edition. $5.

PRACTICAL PHOTOMETRY: A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT. By W. J. DIBDIN. $3.

TRAINS IN IRONWORK, by H. ADAMS. With plates. $1.75

GAS WORKS—THEIR ARRANGEMENT, CONSTRUCTION, PLANT, AND MACHINERY. $5.

COAL; ITS HISTORY AND USE. by PROF. THORPE. $3.50.

THE GAS WORKS OF LONDON, by COLBURN. 60 cents.

HEAT A MODE OF MOTION, by JOHN TYNDALL. $2.50.

THE MANAGEMENT OF SMALL GAS WORKS, by C. J. R. HUMPHRYS. $1.

MANUAL FOR GAS ENGINEERING STUDENTS, by D. LEE, 40 cents.

THEORY OF HEAT, by J. CLERK-MAXWELL. $1.50.

AMMONIA AND AMMONIUM COMPOUNDS, by DR. R. ARNOLD. $2.

THE DOMESTIC USES OF COAL GAS, AS APPLIED TO LIGHTING, by W. SUGG. $1.40.

DIGEST OF GAS LAW. $5.

DISTILLATION OF COAL TAR AND AMMONIACAL LIQUOR, by GEO. LUNGE. New Edition. $12.50.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS, by D. A. GRAHAM 8vo., Cloth. $3.

THE AMERICAN GAS ENGINEER AND SUPERINTENDENT'S HANDBOOK, by WM. MOONEY. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY, by Professor VICTOR VON RICHTER. $2.

ILLUMINATING AND HEATING GAS, by W. BURNS. $1.50.

HANDBOOK FOR MECHANICAL ENGINEERS, by HENRY ADAMS. $2.50.

FUEL AND ITS APPLICATIONS. $7.50.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS, by THOS. NEWBIGGING. Fifth edition. $6

A TREATISE ON MASONRY CONSTRUCTION. BARKER. $5

GAS ENGINEER'S LABORATORY HANDBOOK, by JOHN HORNBY, F I C., $2 50.

GAS LIGHTING AND GAS FITTING, by W. P. GERHARD. 50 cents.

AMERICAN PLUMBING, by ALFRED REVILL. $2.00.

ELECTRICITY.

THE ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage, and Distribution, by PHILIP ATKINSON. $1.50.

ELEMENTARY ELECTRICITY, by PROF. F. JENKIN. 40 cts

ELECTRIC TRANSMISSION OF ENERGY, by G. KNAPP. $3

ELECTRICIAN'S POCKET-BOOK, by MONROE and JAMIESON. $2.50.

MAGNETISM AND ELECTRICITY, by J. OVEREND. 40 cents.

ACCUMULATORS, by SIR D. SALOMONS. $1.50.

DYNAMO BUILDING, by F. W. WALKER 80 cents.

ELECTRIC LIGHTING FROM CENTRAL STATIONS, by G FORBES. Paper. 40 cents.

DOMESTIC ELECTRICITY FOR AMATEURS, by E. HOSPITALIER. $3.

The above will be forwarded by express, upon receipt of price. If sent by mail, postage must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order.

A. M. CALLENDER & CO., 32 Pine Street, New York.

GAS ENRICHERS. GAS COALS. GAS COALS.

The Despard Gas Coal Co.,

MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, - - Clarksburgh, Harrison Co., West Va.
WHARVES, - - - Locust Point, Baltimore, Md.
OFFICE, - - - 44 South Street, Baltimore, Md.

ROUSSEL & HICKS, 71 Broadway, N. Y. } AGENTS, { BANGS & HORTON 60 Congress St., Boston.

ENRICH YOUR GAS

WITH OUR

"BEAR CREEK" CANNEL

Containing

14,630 Cu. Ft. of 41-Candle Gas and 995 lbs. of good Coke per ton of 2,240 lbs.

Log Mountain Coal, Coke & Timber Co.,

PINEVILLE, KY.

MACFARLANE & CO., Louisville, Ky., Agts. for U.S. and Canada.

KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

King's Treatise on Coal Gas.

The most complete work on Coal Gas ever published

Three Vols. Bound, $30.

A. M. CALLENDER & CO., 32 Pine Street, New York.

WILBUR H. TOWNSEND,

BROKER AND DEALER IN

Naphthas, Gas and Fuel Oils and Crude Petroleum for Gas Companies.

Room 115. 29 Broadway, N.Y. City.

— THE —

PENN GAS COAL CO.

OFFER THEIR

Coal, Carefully Screened and Prepared for Gas Purposes.

Their property is located in the Youghiogheny Coal Basin, near Irwin and Penn Stations on the Pennsylvania Railroad, and on the Youghiogheny River.

Principal Office:

Room 720, Reading Terminal Building, Phila., Pa.

Points of Shipment:

Pennsylvania Railroad Piers; Greenwich Wharves, Delaware River; Pier No. 1 (Lower Side), South Amboy, N. J.

EDMUND H. MCCULLOUGH, Prest. CHAS. F. GODSHALL, Treas. H. C. ADAMS, Sec.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

THE SUN OIL CO.,

OHIO CRUDE OIL,

38 to 41 Degrees Gravity.

Toledo, O., and Pittsburgh, Pa.

Standard Oil Company,

GAS NAPTHA DEPARTMENT.

GAS NAPTHA.

GAS OIL.

Correspondence Solicited

26 Broadway, New York City.

RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK. RETORTS AND FIRE BRICK.

J. H. GAUTIER & COMPANY
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,
H. GAUTIER, Prest. CHAS. E. GREGORY, Vice-Prest.
DAVID R. DALY, Sec. & Treas., Gen'l Mangr.

Brooklyn Fire Brick Works,
MANUFACTURERS OF
CLAY RETORTS, FIRE BRICK,
Gas House and other Tile.
Office, 88 Van Dyke St., Brooklyn, N. Y.

LACLEDE FIRE BRICK MFG. CO.,
MANUFACTURERS OF
Fire Brick, Gas Retorts,
AND
ST. LOUIS STANDARD SEWER PIPE.
Blast Furnace and Cupola Linings, every description of Fire Clay Material, Fire Clay Flue Linings, Chimney Tops
Dry Milled and Crude Fire Clays, etc.
OFFICE AND DEPOT
901, 903, and 905 Pine Street,
ST. LOUIS, MO.

ESTABLISHED IN 1845.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Gas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

MANHATTAN FIRE BRICK AND ENAMELED CLAY RETORT WORKS.
ADAM WEBER, Proprietor.
Works, Weber, N. J.
Office, 633 East 15th St., New York.
Modern Recuperative Furnaces
AND
Standard Fire Brick and Gas Retorts.

Works,
LOCKPORT STATION, PA.
—ESTABLISHED 1864.—
JAMES GARDNER, JR.,
Conestoga Bldg., Wood & Water Sts.
PITTSBURGH, PA. P. O. Box 373.
Successor to WILLIAM GARDNER & SON.
Fire Clay Goods for Gas Works.
SOLE REPRESENTATIVE OF THE McILHENNY REGENERATIVE BENCHES FOR THE U. S.

HENRY MAURER & SON,
(ESTABLISHED 1856.)
EXCELSIOR FIRE BRICK & CLAY
RETORT WORKS
WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y
Clay Gas Retorts,
BENCH SETTINGS.
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT.
A cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.
PRICE LIST.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "
C. L. GEROULD & CO.,
N. 3d & Prospect Avs., Mt. Vernon, N.Y.
Western Agent, H. T. GEROULD, Centralia, Ills.

Parker-Russell Mining and Mfg. Co.,
CITY OFFICE,
Mermod-Jaccard Building, St. Louis, Mo.
PROPRIETORS OF THE
OAKHILL GAS RETORT & FIRE BRICK W'KS
Our immense establishment is now employed almost entirely in the manufacture of
Materials for Gas Companies
We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct
Half and Full Depth Benches of Our Own Design,
Containing 6, 8 or 9 Retorts.
We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THOS. SMITH, Prest. AUGUST LAMBLA, Vice-Prest. & Supt
BALTIMORE RETORT & FIRE BRICK CO.
MANUFACTORY AT
LOCUST POINT BALTIMORE MD.
Clay Retorts, Blocks & Tiles
FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.
Red and Buff Ornamental Tiles and Chimney Tops. Drain and Sewer Pipe (from 9 to 30 inches). Baker Oven Tiles 19x19x9 and 10x10x2.
WALDO BROS., 88 WATER ST., BOSTON, MASS
Sole Agents for New England States.

King's Treatise on Coal Gas. In Three Volumes. Price per Vol., $10. Sold either by Volume or in Sets.
Standard text-book for the Engineers and Managers of Gas Works, and for all who are concerned or take an interest in the manufacture and distribution of Coal Gas, and in the utilization of the Secondary Products resulting therefrom; treating also of the Gas Engine and of Gas Cooking and Heating Appliances. A. M. CALLENDER & CO., 32 Pine Street, N. Y. City.

FRED. BREDEL, C. E.,

PROP'R OF KLOENNE AND BREDEL PATENTS.

Recuperative Furnaces, Purifying Machines,

* Gas Apparatus. *

No. 118 Farwell Avenue, Milwaukee, Wis.

Special Trays for Iron Sponge or Oxide of Iron.

CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired.

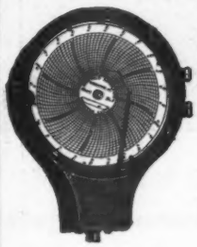
506-510 Eleventh Avenue, New York.

We also make the Cheapest and Strongest REVERSIBLE BOLTED TRAYS IN THE MARKET

Send for Circulars.

BRISTOL'S RECORDING **PRESSURE GAUGE**

For Continuous Records of



Street Gas Pressure.

Simple in Construction,
Accurate in Operation,
Low in Price,
Fully Guaranteed.

Send for Circulars.

THE BRISTOL CO.
Waterbury, Conn.

Received Medal at World's Columbian Exposition.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,

70 Rush St., Near Division Ave., Brooklyn, N.

The Gas Engineer's Laboratory Handbook.

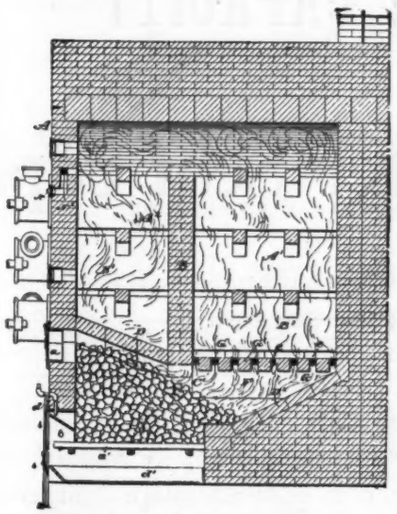
By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 32 Pine Street N. Y. City

FLEMMING'S

Generator-Gas Furnace



Materials furnished and Benches erected by

J. H. GAUTIER & CO., - Jersey City, N. J.

Address as above, or D. D. FLEMMING, Jersey City, N. J.

AMERICAN GAS LIGHT JOURNAL.

$3.00 per Annum.

A. M. CALLENDER & CO.
32 Pine Street, N. Y

The Miner Street Lamps.

Jacob G. Miner,

No. 823 Eagle Ave., New York, N. Y.

Bartlett Lamp Mfg. Company,

MANUFACTURERS OF

Globe Lamps,

FOR

Streets, Parks, Public Buildings, Railroad Stations, etc.

LAMP POSTS

A Specialty.

Office and Salesroom,

39 & 41 W. Broadway, New York City.

Gas Companies and others intending to erect Lamp and Posts will do well to communicate with us.

Parson's Steam Blower,

FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.

PARSON'S TAR BURNER.

FOR UTILIZING COAL TAR AS FUEL.

PARSON'S AIR JET TUBE CLEANER,

FOR CLEANING BOILER TUBES.

These devices are all first-class. They will be sent to any responsible party *for trial.* No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY

H. E. PARSON, Supt., 621 Broadway, N. Y.

DAVIS & FARNUM MFG. CO.

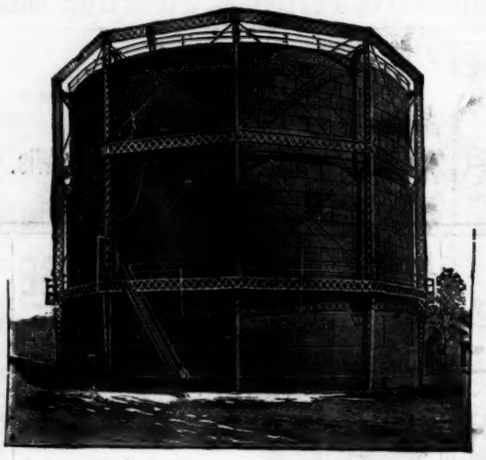
WALTHAM, MASS.

PRINCIPAL OFFICE AND WORKS, WALTHAM, MASS. BOSTON OFFICE, Room 18, Vulcan Building, 8 Oliver Street.

Single, Double and Triple-Lift

Gasholders

of any Capacity.



Tubular, Pipe and Sinuous Friction

Condensers

of all Sizes.

Steel Tanks for Gasholders.

Iron Roof Frames and Floors.

PURIFYING BOXES, CENTER SEAL OR VALVE CONNECTIONS.

BENCH WORK, REVERSIBLE LIME TRAYS.

SELF-SEALING AND PRESSED STEEL MOUTHPIECE LIDS.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Plant.

— ALSO —

GAS AND WATER PIPE, FLANGED PIPE,

Sugar House Work, and Special Castings of all Description.

INCREASE YOUR PURIFYING CAPACITY

BY THE USE OF THE

"Crighton" Four-Box Center Seal Cap.

Having recently perfected and patented a Five-way Center Seal Cap, we are now in position to offer and recommend it to Gas Companies for increasing their purifying capacity at a moderate cost.

With this Cap you can have **all your Purifying Boxes in constant use,** and where four boxes are in operation at one time, **the capacity is increased one-third.**

Your present Center Seal can be used, and will **only require a new Cap.** Under ordinary circumstances **the change can be made in one day,** and will not necessitate the disturbing of your connections.

Now is the time to make the change, as the work can be done to good advantage during the season of your lightest output.

For information and prices address

KERR MURRAY MFG. CO.,

Manufacturers of Gas Works Apparatus and Holders,

FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Triple, Double & Single-Lift

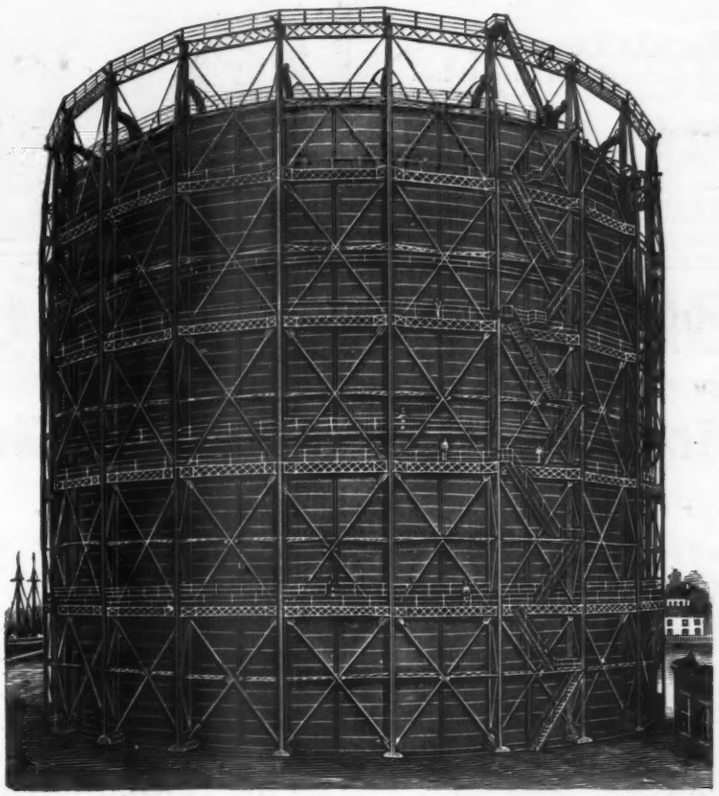
GASHOLDERS.

Iron Holder Tanks.

ROOF FRAMES.

Girders.

BEAMS



PURIFIERS.

CONDENSERS.

Scrubbers.

Bench Castings.

OIL STORAGE TANKS.

Boilers.

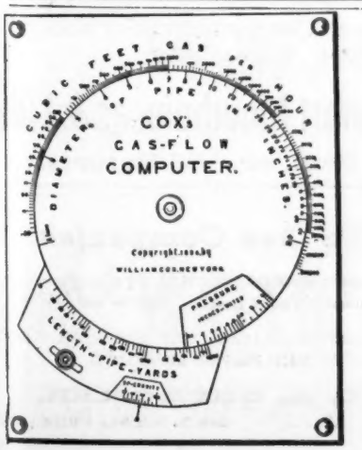
Three Four-Lift Gasholders, each of 4,289,500 Cubic Feet Capacity, Erected in Chicago.

The Wilkinson Water Gas Process.

THIRTY-CANDLE, NON-CONDENSABLE, FIXED GAS. THE MOST SUCCESSFUL GAS PROCESS IN OPERATION.

MILL'S REVERSIBLE LIME TRAYS.

Gas Works Designed and Constructed.



Cox's Gas Flow Computer.

1. It gives at a glance the discharge of gas from pipes 1 to 48 inches in diameter and 10 to 10,000 yds. long, for any pressure from 0.1 to 4.0 inches of water, and any specific gravity from 0.40 to 1.00.

2. When the required discharge and the length of pipe are given, the diameter corresponding to any pressure is at once seen.

3. When the required discharge and the length of pipe are given, the pressure corresponding to any diameter is at once found.

4. Any suitable combination of the different factors of any problem, under all possible conditions, may be immediately found.

It Prevents Errors and Saves Hours of Tiresome Calculations.

Price, $10.00, per Registered Mail.

Where it can be seen and proved:

A. M. CALLENDER & CO., 32 Pine St., N.Y., or WM. COX, C.E., Stapleton, N. Y.

R. D. WOOD & CO., ENGINEERS, IRON FOUNDERS, M CHINISTS.

400 Chestnut Street, Philadelphia, Pa.

MANUFACTURERS OF

CAST IRON PIPE.

BUILDERS OF

Gas Holders,

Single, Double and Triple Lifts, with or without Wrought Iron or Steel Tanks.

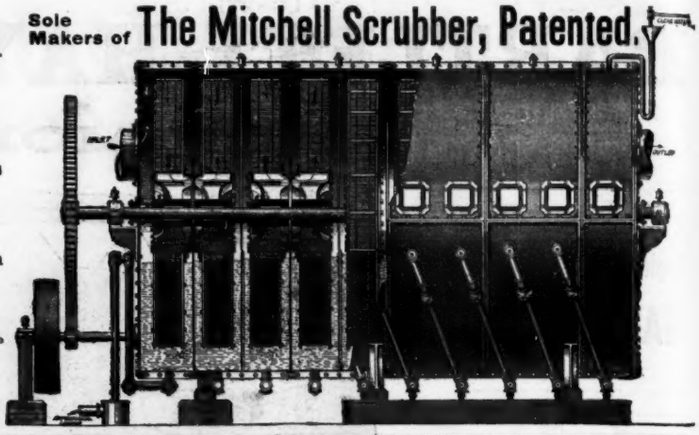
PURIFIERS, CONDENSERS, SCRUBBERS.

The Hopper Automatic Gas Governor

Send for Pamphlet.

Dunham Patent Specials.

Sole Makers of **The Mitchell Scrubber, Patented.**



ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

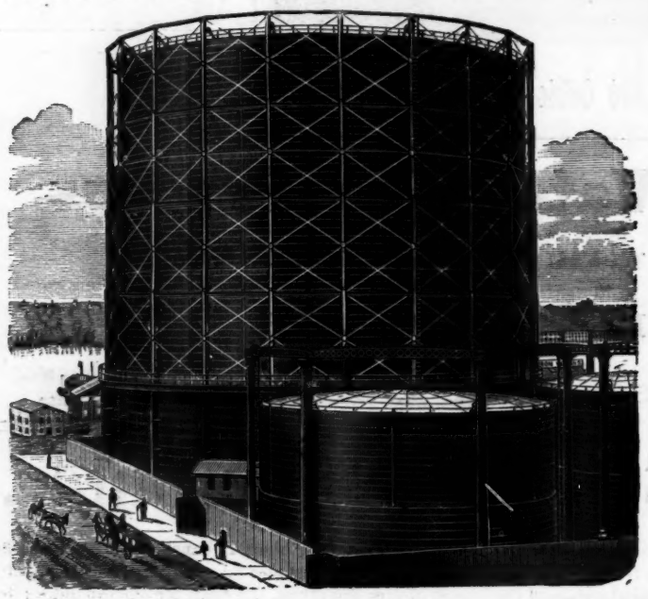
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. —OFFICES— **Bridge & Ogden Sts., Newark, N. J.**



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

BROOKLYN, N. Y.

TAKE EAST TENTH OR TWENTY-THIRD STREET FERRIES FROM N. Y. TO GREENPOINT.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

ILLUMINATING GAS! FUEL GAS!

THE LOOMIS PROCESS.

Now in successful operation at Works of John Russell Cutlery Co., Turner's Falls, Mass., and Henry Disston's Son's Saw Works, Tacony, Pa.

The Cheapest Gas Generating System in the World.

Plans and Estimates Furnished.

BURDETT LOOMIS, - - Hartford, Conn.

To Gas Companies.

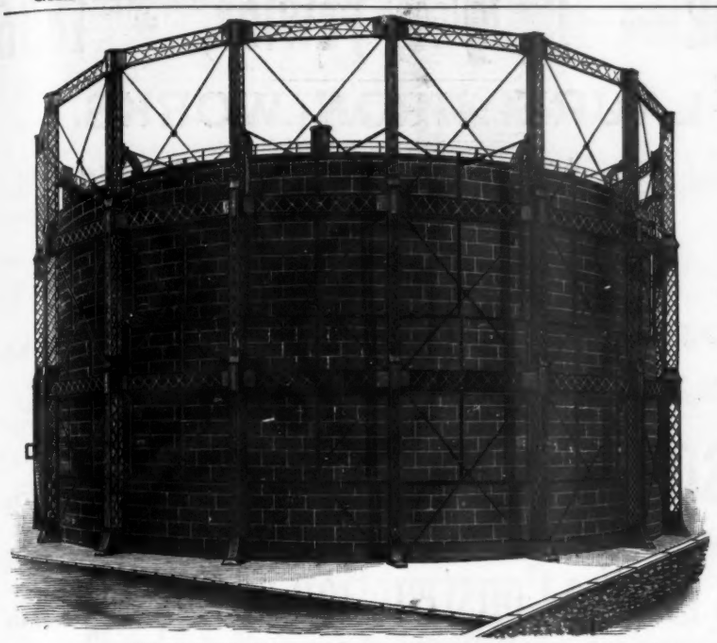
We make to order **CAP BURNERS** to burn any amount under a stated pressure. Send for samples.

Also, SERVICE CLEANERS, DRIP PUMPS, and STREET MAIN PROVING APPARATUS.

C. A. GEFRORER,

248 N. 8th St., Phila., Pa.

GAS WORKS APPARATUS AND CONSTRUCTION. GAS WORKS APPARATUS AND CONSTRUCTION.



H. RANSHAW, Prest. & Mangr. T. H. BIRCH, Asst. Mangr
WILLIAM STACEY, Vice-Prest. R. J. TARVIN, Sec. & Treas.

THE STACEY MANUFACTURING CO.

Established 1851.

Single, Double and Triple-Lift

GASHOLDERS,

Of any Capacity, with or without Wrought Iron or Steel Tanks.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, etc.

Coal Gas Benches, Roof Frames,

OIL STORAGE TANKS.

Pressed Steel Mouthpiece Lids, Self-Sealing Mouthpiece Lids.

Cincinnati, Ohio.

George Shepard Page's Sons,

Sole Agents for

The "Standard" Washer-Scrubber,

The Walker Tar and Carbonic Acid Extractor, The Walker Sulphate and Ammonia Still,
The Walker Self-Sealing Pressed Steel Mouthpiece Lids.

The Berlin Center Valve. And Contractors for Ammoniacal Liquor.

No. 69 Wall Street, New York City.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

H. C. SLANEY,
Gas Engineer
466 Sixth Street, Brooklyn, N. Y.
Plans, Specifications and Estimates furnished for New Works, Alteration or Extension of Old Plants.

T. G. LANSDEN,
Consulting and Contracting Gas Engineer.
Estimates, Plans and Specifications for New Works (Coal or Water Gas), and for Extensions or Alterations.
Security Bldg. (Room 206), St. Louis, Mo.

WM. HENRY WHITE,

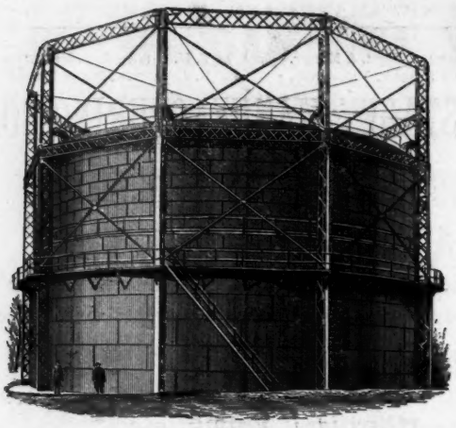
No. 32 Pine Street, - - - New York City.

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited
Plans and Estimates Furnished.



1842 * Deily & Fowler, * 1895

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

JAMES R. FLOYD & SONS,

Successors to HERRING & FLOYD,

Oregon Iron Works,

West 20th and 21st Streets, Between 10th & 11th Avenues, New York City.

Engineers and Contractors for the Construction of Gas Works.

MANUFACTURERS OF ALL KINDS OF CASTINGS AND GENERAL IRONWORK FOR GAS APPARATUS.

Bench Castings, Regenerative and Half Regenerative Furnace Castings, Condensers, Tower Scrubbers, Mechanical Scrubbers, Purifiers, Malleable Iron Retort Lids, Self-Sealing Retort Lids, Hydraulic Hoist Purifier Carriage, Crosses, Tees, Bends, Angles, Reducers, S-Bends, Sectional Sleeves, Plugs, Caps, Street Drips, etc., always on hand.

WOOD'S GAS SCRUBBING AND ENRICHING APPARATUS.

In use at Syracuse, Auburn, Watertown, Cortland and Geneva, N.Y.; Elizabeth, N. J.; Boston, Mass.; Jamaica Plain, Mass.; Providence, R. I.; Northern Liberties Gas Co., Phila.

Sole Manufacturers of the OGDEN QUICK-MOVING VALVE.

Premium Awarded, World's Columbian Exposition.

SELLER'S CEMENT. Plans, Specifications and Estimates furnished for the Construction of New or the Alteration of Old Works.

INTERESTING TO GAS MANUFACTURERS!

The

Wilke China Kiln.

For Firing Decorated China with Illuminating Gas.

AWARDED THE HIGHEST HONORS, MEDALS AND DIPLOMAS AT THE WORLD'S COLUMBIAN EXPOSITION.

Many Valuable Improvements added to this Kiln in the Last Year.

Not a Toy, but a Practical Kiln.

Has Never Failed to Give Satisfaction.

Guaranteed to fire China successfully, and without any discoloration from fuel used.

Thousands in use, and not a single failure.

Full directions furnished with each Kiln sold by which any amateur can fire it without any previous knowledge of this branch of the work. Send for descriptive circular. Address

F. A. WILKE,
Richmond, Ind.

The Addyston Pipe & Steel Co. Cincinnati, O.

make all kinds of special castings of improved designs necessary to the perfect equipment of sewer and water mains, including iron

Crosses, Tees, Elbows, Reducers, Sleeves, Caps, Plugs, Valve Boxes, Drip Boxes, Man-holes, Gutter Plates, etc.

These are kept in stock and can be shipped in short notice. Explicit directions can be given so as to insure delivery of proper sizes

JOS. R. THOMAS,

No. 32 Pine Street, N.Y. City.

CONSULTING AND CONSTRUCTING

Gas Engineer and Contractor.

PLANS, SPECIFICATIONS AND ESTIMATES FURNISHED.

Contracts taken for all Appliances required at a Gas Works.

Either for New Works or Extensions to Old Plants.

The Gas Engineer's Laboratory Handbook.

BY JOHN HORNBY, F.I.C. Price, $2.50.

A. M. CALLENDER & CO., - - No. 32 Pine Street, New York City.

GAS AND WATER PIPES.

THE OHIO PIPE COMPANY,

MANUFACTURERS OF

Cast Iron Gas & Water Pipe,

BRANCH AND SPECIAL CASTINGS.

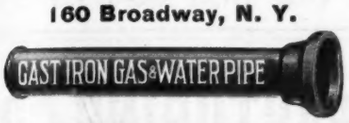
Gas-House Bench Castings, Hydraulics, Lamp Posts, Flange Pipe and Specials, Architectural Castings, Building Columns, Joists, Cellar Grates, Sash Weights, etc.

GENERAL FOUNDERS AND MACHINISTS

Columbus, Ohio.

JOHN FOX,

160 Broadway, N. Y.



SPECIAL CASTINGS, FLANGE PIPE, FIRE HYDRANTS, STOP VALVES, LAMP POSTS, Etc., Etc.

General Foundry and Machine Work.

GAS METERS.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc

M. J. DRUMMOND,

SPECIAL CASTINGS AND LAMP POSTS.

Office, Corbin Building, 192 Broadway, N. Y.

GEORGE ORMROD, Manar. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA

MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

1894 DIRECTORY 1894

OF AMERICAN GAS COMPANIES

Price, - - - - - - - - - $5.00.

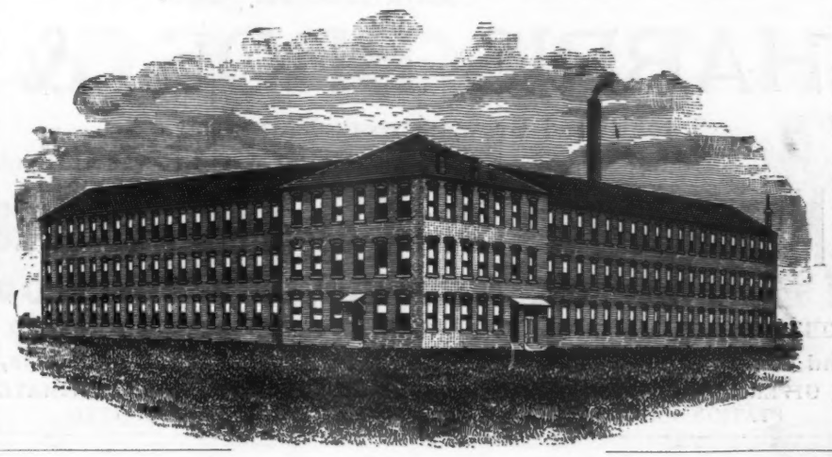
A. M. CALLENDER & CO., - - No. 32 Pine Street, New York.

N. Y. AGENCY,

Bartlett Lamp Mfg. Co.,

39 & 41 W. Broadway,
New York City.

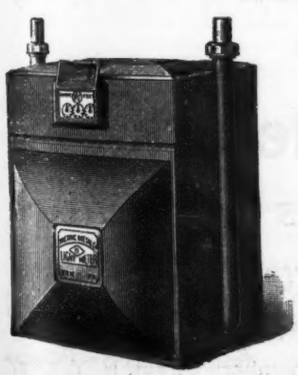
Telephone, 1125 Courtlandt.



Factory
and Office

ERIE, PA.

ESTIMATES FURNISHED ON APPLICATION.



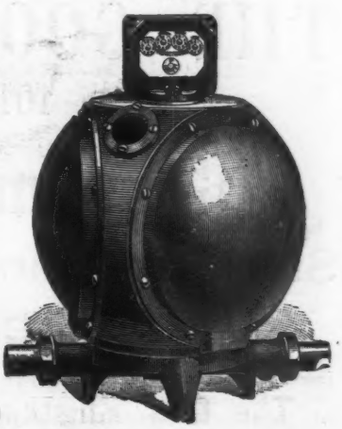
METRIC METAL CO.,

MANUFACTURERS OF

Dry Gas Meters

FOR ALL KINDS OF SERVICE.

Special Attention Paid to
REPAIRING METERS OF ALL MAKES.



Agts., McELWAINE-RICHARDS CO., 62 & 64 W. Maryland St., Indianapolis, Ind

Established 1849.

With the best facilities for manufacturing, is enabled to furnish reliable work and answer orders promptly.

NATHANIEL TUFTS,

153 Franklin St., Boston, Mass.

C. W. HINMAN, - - Manager.

MANUFACTURER OF

DRY GAS METERS.

Station Meters of any Capacity.

Test and Experimental Meters, Pressure Registers, Pressure Gauges.

METER PROVERS, PHOTOMETERS, STREET LANTERNS, ETC., ETC.

Apparatus for the Chemical Testing of Gas and Gas Liquor.

CHARLES E. DICKEY. JAMES B. SMALLWOOD. CHARLES H. DICKEY.

THE MARYLAND METER AND MANUFACTURING CO.

Established 1866.

BALTIMORE, North & Saratoga Sts. **CHICAGO, 122 & 124 Michigan St.**

NEW YORK, 838 Broadway. **SAN FRANCISCO, 221 Front St.**

BOSTON, 92 Water Street, Rooms 21 and 22.

CONSUMERS' & STATION METERS, PRESSURE GAUGES, Etc., Etc.

"Success" and "Perfect" Gas Stoves.

Established 1849.

HARRIS BROS. & CO.,

Twelfth and Brown Streets, Phila., Pa.

Agency, 67 & 69 S. Canal Street, Chicago.

Manufacturers of Wet and Dry Gas Meters,

STATION METERS, METER PROVERS,

EXPERIMENTAL METERS, SHOW OR GLAZED METERS,

Pressure and Vacuum Registers, Gauges, Photometers, Drip and Bell Pumps, Etc., Etc.

PROMPT ATTENTION GIVEN TO ALL ORDERS. METERS THOROUGHLY REPAIRED. ESTIMATES FURNISHED FOR STATION METERS OF ALL SIZES. CORRESPONDENCE SOLICITED.

THE GOODWIN METER COMPANY,

1012-1018 Filbert Street, Philadelphia, Pa.

MANUFACTURERS OF

Consumers' and Station Meters,

Standard Photometrical and Analytical Gas Apparatus

"SUN DIAL" GAS COOKING AND HEATING STOVES.

Particular attention given to Repairing Meters and Scientific Apparatus. . . .

GEORGE B. EDWARDS, Agent,
113 Chambers Street, N. Y. City.

GAS METERS. GAS METERS. GAS METERS.

WM. N. MILSTED, Prest. and Genl. Supt. WM. H. HOPPER, Vice-Prest. PAUL S. MERRIFIELD, Sec. and Treas.

THE AMERICAN METER CO.

Established 1834. Incorporated 1863.

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTER VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR & JET PHOTOMETERS.

Manufactories:
512 West 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES.
SUGG'S "STANDARD" ARGAND BURNERS,
SUGG'S ILLUMINATING POWER METER,
Wet Meters, with Lizar's "Invariable Measuring" Drum.

Agencies:
125 & 127 S. Clinton Street, Chicago.
810 North Second Street, St. Louis.
222 Sutter Street, San Francisco.

HELME & McILHENNY,

(Established 1848.)

Gas Meter Manufacturers

1339 to 1349 Cherry Street, Philadelphia, Pa.

Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Center Seals, Pressure Registers, Governors, Indicators, Photometers

AND ALL OTHER KINDS OF APPARATUS FOR USE IN GAS WORKS.

FOULIS' PATENT STATION AND DISTRICT GOVERNORS.

REPAIRING DEPARTMENT.—We employ a special force of skilled workmen repairing meters of ALL MAKERS.

D. McDONALD & CO.,

Established 1854.

154 West 27th Street, NEW YORK CITY. | **51, 53 & 55 Lancaster St., ALBANY, N. Y.** | **34 & 36 W. Monroe St., CHICAGO, ILL.**

MANUFACTURERS OF

Wet and Dry Gas Meters

STATION METERS, EXPERIMENTAL METERS, METER PROVERS, PRESSURE & VACUUM REGISTERS & PRESSURE GAUGES.

Meters of all makers Thoroughly Repaired.

W. H. PEARSON, President. J. T. WESTCOTT, Gen'l Mang'r & Treas. L. L. MERRIFIELD, Chief Engineer.

The Economical Gas Apparatus Construction Co., Ld.

269 Front Street, East, - - Toronto, Canada.

ENGINEERS AND BUILDERS

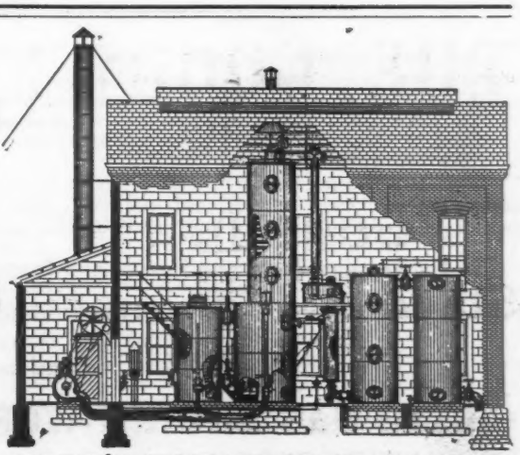
OF THE

Improved Lowe Water Gas Apparatus

Designed to give the Greatest Efficiency when using any kind of Oil, Anthracite Coal, Gas House or Oven Coke.

New Gas Works Built, Present Gas Plants, either Coal or Water, Remodeled

Catalogues, Plans and Estimates Furnished upon Application.



LOWE WATER GAS APPARATUS, MERRIFIELD-WESTCOTT-PEARSON SETTING.

The advertisement of

JOHN J. GRIFFIN & CO., Mfrs. of Gas Meters, etc.,

Nos. 1513, 1515, 1517, 1519 & 1521 Race Street, Philadelphia,
52 Dey Street, New York, 75 N. Clinton Street, Chicago,

Occupies this page every alternate week

UNEQUALED

For efficiency and low gas consumption.
For smooth and quiet running.
For simplicity of construction and grace in design.
For general reliability.
For close regulation of power.

150 MEDALS AND DIPLOMAS.

The "OTTO"--The First.

The First to use the four-stroke cycle. **The First** to admit well measured and distinct charges of gas into an air space. **The First** in the adoption of poppet valves. **The First** to develop the tube igniter, with automatic or timed firing. **The First** to have a reliable electric and a practical magnectic igniter.

THE FIRST SMOOTH RUNNING & NOISELESS GAS ENGINE COMBINING EFFICIENCY & SIMPLICITY.

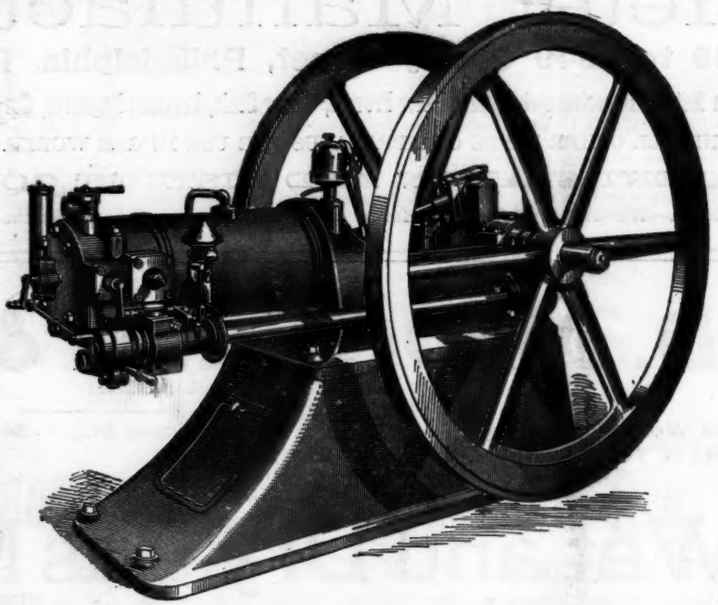
Our Columbian Style

IS FITTED

With removable seats and casings for all valves.

With Patent Alloy Tube, good for one year.

With timing device for ignition, preventing starting backward; or with electric igniter.



SIMPLICITY, as far as is possible, with good design and perfect Working. Built on scientific principles, with a view to **HIGHEST EFFICIENCY**

Sizes,
1-3d to 120 H.P.

The First and Only Engine To-day to Please Every Purchaser.

DEMONSTRATION

It is almost a quarter of a century since the "Otto" revolutionized old and bad practices by introducing principles of combustion "entirely new" in the construction of Gas Motors.

A quarter of a century of uninterrupted success has demonstrated the correctness of these principles.

The gas engine history of the past proves that all competitors have recognized this fact by becoming imitators.

Since its advent the "Otto" engine has been illustrating mechanical improvement without alteration, while others have been offering alterations as improvements.

The experience of the past shows that it requires years to determine the real merits of a gas engine, and that nearly all new gas engines prove failures. **The fittest survive, and the only safe thing to do** in selecting a gas engine is to buy what the tests of practical use, through a long period of time, have proven to be the best.

The Practical Tests of a Quarter of a Century have Demonstrated that the "OTTO" Stands To-day Unrivaled

For simplicity of construction and grace in design; for general reliability and ease of management; for quiet and smooth running qualities; for efficiency and low gas consumption; for regularity of speed and close regulation of power.

"OTTO GAS ENGINE WORKS," 33d & Walnut Streets, Phila., Pa.

NEW YORK 18 Vesey St BOSTON, 19 Pearl St. CHICAGO, 245 Lake St.